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[OFFICIAL NOTICE.]

Fortieth Annual Meeting, New England Association of Gas Engineers.

NEW ENGLAND ASSOCIATION OF GAS ENGINEERS,
OFFICE OF THE SECRETARY,
EAST BOSTON, MASS., Jan. 19, 1910.

The 40th annual meeting of the New England Association of Gas Engineers will be held at Young's Hotel, Boston, Wednesday and Thursday, Feb. 16 and 17, 1910. Interesting papers on subjects relating to various topics on gas industries are being prepared, titles of which will be announced later. Members having suggestions, questions or names of applicants for membership should send them to the Secretary at once.

N. W. GIFFORD, Secretary.

[OFFICIAL NOTICE.]

Annual Meeting, Southern Gas Association.

SOUTHERN GAS ASSOCIATION,
OFFICE OF THE SECRETARY,
ROME, GA., Jan. 10, 1910.

To the Members, Southern Gas Association: The Annual Meeting of the Southern Gas Association will be held in Chattanooga, Tenn., February 16th, 17th and 18th, next. Headquarters, Hotel Patten. Further information will be given later. Respectfully,

JAMES FERRIER, Secretary.

[OFFICIAL NOTICE.]

Wrinkle Department, American Gas Institute.

WRINKLE DEPARTMENT, AMERICAN GAS INSTITUTE,
OFFICE OF EDITOR, ELECTRIC AND GAS BUILDING,
ATLANTA, GA., Jan. 10, 1910.

To the Members of the American Gas Institute: Please forward contributions for the Wrinkle Department to the above address. I would suggest that each manager address a letter of solicitation to the head of each department of his Company. Kindly assist me in this work I have undertaken, and greatly oblige, Very respectfully yours,

R. C. CONGDON, Editor.

[SPECIAL OFFICIAL NOTICE.]

Bureau of Information, American Gas Institute.

DETROIT CITY GAS COMPANY,
ENGINEERING DEPARTMENT,
DETROIT, MICH., Nov. 26th, 1909.

To the Members, American Gas Institute: Send questions to be submitted to the Bureau of Information for answer to V. F. Dewey, Chairman, Gas Office Building, Detroit, Mich. The Bureau of Information respectfully solicits your troubles. Yours respectfully,

V. F. DEWEY, Chairman.

BRIEFLY TOLD.

SUMMARY OF ANNUAL REPORT, PUBLIC SERVICE COMMISSION, SECOND DISTRICT, NEW YORK.—We are indebted to the good offices of Mr. Jno. S. Kennedy, Secretary Public Service Commission, Second New York District, for a summary of the Report to the Legislature of the doings of that body for the 12 months ended December 31, 1909. The Report, which is a very bulky document, goes into nice detail over the matters reviewed and, all things considered, it is a document that reflects much credit upon its compilers, who also are to be congratulated over the celerity with which this mass of matter was digested. Passing to the pages devoted to returns entitled, "Gas and Electrical Corporation Supervision," these remarks are made: In matters pertaining to the supervision of gas and electrical corporations, the report sets forth in detail the results of two special investigations, the first relating to the necessity for a heating power standard in measuring the value of gas, the second to the practice of the companies in requiring cash deposits from consumers. Gas is now

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furnished in accordance with the illuminating power requirements, which the investigation discloses serve as a standard for probably not more than 20 per cent. of the entire output, the proportion used in open-flame burners. The balance of the supply is either burned in mantles or consumed for domestic and industrial fuel purposes, and in all of these uses its heating value, rather than its illuminating value, is of primal importance. Upon the information at hand as to the situation, the Commission has invited representatives of the companies and gas engineers to meet with it in conference on February 1, 1910, to consider the necessity of fixing a calorific standard. The authority so to do, however, must first be obtained from the Legislature through appropriate amendments to the law. Certain complaints having been made of alleged abuses existing in connection with the practice of gas and electrical corporations requiring cash deposits of consumers, an inquiry was made into this subject. The results show that at present 129 corporations hold deposits in the aggregate amount of about $468,000, paid in by upwards of 51,000 consumers, and that from time-to-time, since about 1890, when the authority was first given the companies to require such security, deposits have been returned to consumers, either directly by refunding, or indirectly through credits, in an amount exceeding $1,000,000. The practice of the companies was found not to be uniform in recording deposits when received, in allowing and paying interest, and in fully informing the depositor of the terms and conditions upon which the deposit is exacted, held and may be withdrawn. The year's tests of gas for illuminating power and purity afford just grounds for criticism of many of the supplying companies. Either in candle power or the presence of impurities 38 per cent. of all the tests, 887 in number, showed deficiencies. Examination made of 33 plants revealed that in most instances the failure to comply with existing standards is very largely due to either improper gas making equipment or to censurable methods of manufacture. During the year 98,895 gas meters were tested, of which 95,297 were verified and sealed as correct within the 2 per cent. limit of error allowed by law, and 3,598 were rejected. Electrical corporations have been required to make periodic tests of consumers' meters, using standards that are checked for accuracy by inspectors of the Commission; 78,116 electrical meters were tested, of which 69,000 were found accurate within 4 per cent., 20 per cent. were found 4 per cent. or more slow and 11 per cent., 4 per cent. or more fast. In the Commission's supervision of this work 1,744 electrical station standards were checked for accuracy.

ANNUAL MEETING, ILLUMINATING ENGINEERING SOCIETY.—The annual business meeting of the Illuminating Engineering Society was held in the handsome quarters of the Machinery Club, New York, the evening of the 14th inst. It was preceded by a most enjoyable dinner, during which the spirit of true fraternality prevailed. The retiring President, Mr. W. H. Gartley, Engineer of the Philadelphia Works, United Gas Improvement Company, occupied the chair and introduced the various speakers with his usual dignified but nevertheless enjoyable pleasantness. He was particularly gratified at the increasing interest being taken by the gas fraternity at large in the work of the Society, and asserted that the past year had proved that in the great business of making and selling illumination there was room for all. There were a number of informal addresses, the first by Mr. E. N. Wrightington, of Boston, President of the National Commercial Gas Association, who pointed out that the real business of both gas and electric companies in selling illumination, heat and power, instead of so many cubic feet or watts, was much nearer being realized than ever before, which fruitful result aud happy advance were due largely to the work of the Society. Taking up the matter of the conservation of energy, he stated that in no other field was there greater opportunity of preventing economic waste than in the lighting field. Mr. Gartley next introduced Mr. W. R. Addicks, Vice-President and General Manager of the New York Consolidated Gas Company, who stated that the gas industry needed the services of the illuminating engineer more than did the electric industry, because gas installations not being as flexible as those where electricity was the illuminant should, therefore, be planned with greater care. Mr. Addicks was followed by Mr. A. S. Terry, Vice-President of the National Electric Lamp Association, who spoke of the great interest taken by his Company in the newer art, especially as both gas and electric men had the opportunity of getting together on a friendly footing, since any improvement in one system was sure to benefit the other. Secretary P. S. Millar then briefly abstracted his report as to the work accomplished during the year. The membership figures are as follows: On January 1, 1907, the membership was 1,005, and at date it was 1,03[illegible]. The several sections had held 33 meetings, the greatest average attendance being in Philadelphia, with 85. The Chairman of the Finance Committee (Mr. J. S. Codman) then presented the results from a financial standpoint, for despite the fact that although $500 had been spent on research, the surplus was greatly augmented, it being now close to the $3,000 mark. The annual election resulted in the following being returned as office bearers:

President—Dr. Edward P. Hyde.
Vice-President—V. R. Lansingh.
Treasurer—W. C. Morris.
General Secretary—P. S. Millar.
Directors—L. B. Marks, E. B. Rosa and E. W. Lloyd.

The popularity of the President-elect was at once apparent, if one might judge from the ovation he received. In acknowledging his elevation he asked for co-operation to bring about greater harmony and a better understanding of the theory and practice of illumination, and hoped that the Society would be more successful than ever through its dissemination of useful, practical knowledge. If educational work were to be undertaken it should begin at home, he remarked, and to that end a course of lectures should be given by the leaders in the art. The last, but not the least important matter brought up, was the report of the Committee on Division of Membership, which was read by the Chairman, Mr. E. L. Elliott. The Committee, while favoring a division, admitted its inability to make specific recommendations, and, after considerable discussion, by Messrs. Jones, Marshall, Kemble, Gardiner and Owens, on motion of Mr. Kemble it was proposed to continue the Committee, with instructions to report final suggestions in ample time for discussion at the annual convention. After an informal discussion concerning the next convention, the thus far most successful annual meeting of the Society was declared adjourned.—SHARER.

THE INDIANA GAS ASSOCIATION'S ANNUAL MEETING.—INDIANAPOLIS, IND., January 21, 1910.—Dear JOURNAL: The annual meeting of the Indiana Gas Association was carried to a successful completion yesterday, after a 2 days' session. Although only a small Association (there are 43 Companies in the State) we nevertheless deemed organization a necessity. That in 2 years we have done much towards that end is shown in the fact that last year we had 30 Companies on our rolls; now we virtually have then all and to spare, since the organization on such account this year numbered 19. The excellent proceedings were abetted by good weather, excellent hotel accommodations, and an *esprit du corps*, the realness of which was shown in the cheer that went up when a telegram from our own "Jim." T. Lynn, announcing that the voting in Port Huron, over the new franchise for the Lynn Company at that point showed a majority of 25 per cent. in favor. Governor Marshall—all glory to his greatness—received us with welcome speech, and we were later on favored by an address from Mr. Harry Dowling, who recently retired from the State Board of Railroad Commissioners, to again take up the practice of law in Indianapolis. It is needlesc to say that the only Dunbar made an excellent presiding officer, and that "Phil." Eves, as Secretary-Treasurer, left nothing undone that he should have done. Mr. Dunbar declined a re-election. The officers chosen were: President, Carl H. Graf; Vice-President, S. E. Mulholland—he certainly does believe that his latter state is vastly better than was his first— he's a good one, you know—Secretary-Treasurer, Philmer Eves. The next meeting place will be Fort Wayne. The literary order was of exceeding interest, and the social side was all to the best.—NEW ALBANY.

Book Reviews.

Catechism of Central Station Gas Engineering Practice in the United States.—Trustees Gas Educational Fund. Price $5.

The delay in issuing this valuable addition to gas lighting literature may perhaps have been due to the somewhat unwieldly title, but it is with us now and is likely to achieve its place on our 5-foot shelf as time rolls on. Questions numbering 368, and the replies thereto, have been crowded into less than 700 pages, so that we must be forgiven if all that we desire to find is not embodied therein, even if many of the answers given lack a directness of style, which would greatly improve matters. The chief merit in the work lies in the fact that through the perusal and correction of thousands of answers to the questions, the Secretary has had the opportunity of revising the answers for their final printing. Would that like attention had been given to the index. In order that the volume may reach the younger members of the profession, a low price has been made, and if they would but apply themselves to the task of acquiring a basis for a gas engineering education, they will find that it contains full value for the money spent.

Turbine-Driven Gas Blowers.

[Communicated by MR. C. V. KERR.]

Until recently the accepted way of providing blast for the generators in gas works was to drive the high pressure, high speed blowers by means of belts from high speed steam engines, but the varying tension and condition of belting necessarily made such a drive more or less unreliable. Belts were either broken or would slip, and the capacity of the generators was affected according to what happened at the blower.

Fig. 1 affords an illustration of a typical modern gas blower, made

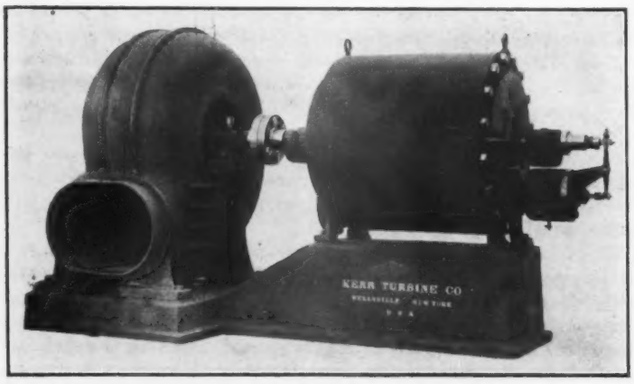


Fig. 1.—80-Horse Power Form 187 Kerr Steam Turbine, Running at 2,100 r.p.m., Connected to No. 8 Sturtevant Extra Heavy Gas Blower, Delivering 16,000 Cubic Feet Air per Minute, Installed at Mexican National Gas Company's Plant, Mexico City, Mexico.

extra heavy for long and continued service, driven by a steam turbine, at a speed required by the desired pressure. This particular steam turbine is of the nozzle and-bucket or impulse type, following the Pelton system of using water under high pressure in double cup-buckets, with a construction of casing, nozzle and bucket adapted to the use of steam. The shell of the turbine is built in circular sections, made steam tight at the joints by fiber packing, backed by metal-to-metal joints, which prove extremely useful in service. This construction permits rapid taking down of the turbine when necessary, and also gets rid almost entirely of troubles due to heating of the parts of the turbine by steam.

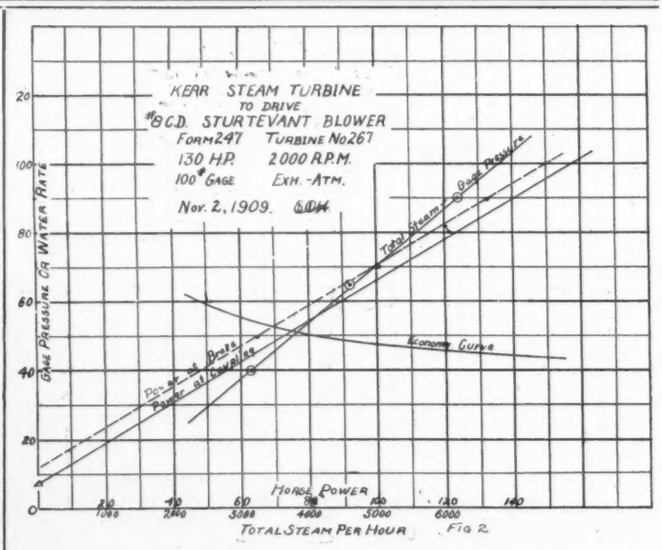
The bearings are of the ring, oiling-type and, on account of heat being transmitted to the bearings by radiation, along the shaft and to heat developed in the bearing itself by friction, cylinder oil is used for lubrication. Such an oil will run indefinitely, at a temperature as high as 200° F., with perfect safety as it has a lubricating range of at least 400°.

The governor of the turbine is of the centrifugal type and the weights are made semi-circular on account of the small diameter required by the high sgeed of rotation. The movement of the weights is transmitted through a rolling contact to the valve stem through the lever shown. The valve itself is of the double-beat, poppet type, and controls the speed of the turbine by throttling the steam. The speed of the blower, depending on the air pressure desired, may be varied several hundred revolutions by simply, adjusting the tension of the governor spring.

The turbine shown in Fig. 1 is a 24-inch Kerr steam turbine, rated at 130 b. h. p., at a speed of 2,100 r. p.m. The initial steam pressure is 100 pounds and the exhaust is atmospheric. Under the conditions stated above the steam per b. h. p. hour was guaranteed at 44 to 45 pounds.

All of the turbines built by the Kerr Turbine Company are tested under as near actual operating conditions as possible before shipment. A prony brake of the block type is used to grip the brake pulley with internal flanges. The stream of water is thrown into each end of this pulley and the water under centrifugal force passes out through the holes drilled in the rim of the pulley on to the working surface of the brake where the friction heat is developed. This construction has given very high absorptive power for the type of brake with a high surface speed and steady running.

On the curve shown by the diagram in Fig. 2, the dots on the line, "Power at Brake," show results from the test on this particular turbine. To eliminate the losses in the brake itself, due to operating friction and vibration, the turbine is run at rated speed with the coupling disconnected. The pressure required to do this is shown at



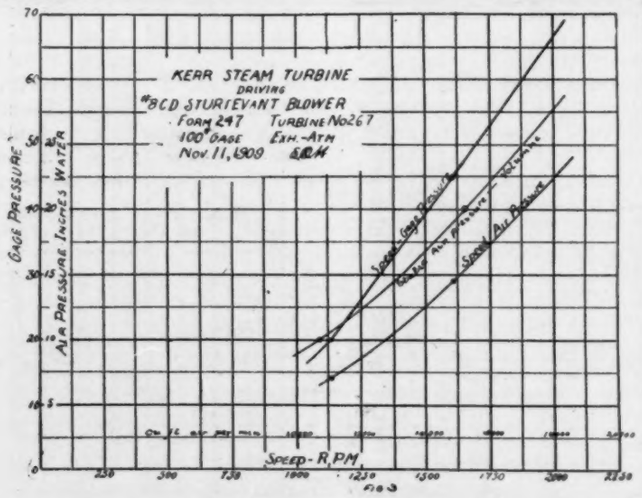
the point surrounded by a triangle. Through this point a line, called "Powor at Coupling," is drawn parallel to the line of "Power at Brake." In connection with these tests a calibrated steam gauge is connected to the steam chest of the turbine just below the governor valve. The pressures found there are indicated by the ordinates on the diagram in Fig. 2, showing gauge pressure. From the curve of "Power at Coupling" the horse power transmitted through the coupling for any given steam pressure fixed by the governor can be ascertained.

It has been found in practice that the steam flow through the turbine is the same whether standing or running. For convenience in testing, the steam flow through the turbine is determined with the turbine held still by the brake. The results of such steam flow test for three different points are shown in the curve called "Total Steam Gauge Pressure." From the two curves thus determined the economy curve is calculated. To use the exact figures from the test, with an initial pressure of 90 pounds in the steam chest and atmospheric back pressure, the turbine developed 140 b.h.p. at 2,003 r.p.m. with an actual water rate uncorrected for moisture of 44 pounds per b.h.p. hour. In the turbine such a water rate will be maintained indefinitely, as it is not liable to loss of power through leakage past pistons and valves as in the case of the steam engine.

Unlike the steam engine again the steam turbine has its best speed higher than that of even the pressure blower. To meet this condition the B. F. Sturtevant Company brought out a specially designed form of extra heavy gas blowers called the "Turbine Type." It is distinctive, as seen in the illustration, by the oval mouth in place of the usual circular one. This construction permits making the wheel or runner wider for a given diameter and, therefore, secures a higher rotative speed for the same capacity in air per minute. In this case the blower was rated at 16,000 cubic feet of air per minute against 14-ounce pressure or 24 inches wates gauge.

In Fig. 3, are shown curves plotted from data obtained on the test made of the complete unit. This shows the relation between speed, gauge pressure and air pressure, and will require no explanation. The blower discharged air through a nozzle 4 feet long tapered from the full size of mouth of blower to an orifice 12.75-inch diameter. The area of the mouth of the blower is 2.76 square feet, while the nozzle area is 0.886 square foot. The ratio of nozzle to mouth area is 0.32.

In this case the air pressure was measured at the mouth of the turbine, and from it the volumes shown in the curve giving relation of static air pressure to volume were calculated. At 24 inches water pressure, equal to 14-ounce pressure, the volume discharged is seen to be well above the rated capacity. In this case, as a matter of fact, the calculations did not show the full discharge, for no account was taken of the velocity through the mouth of the blower. The relatively small amount of power required by the blower at rated capacity is shown by the fact that only 67-pound steam chest pressure was required to drive the blower at a speed giving 22½ inches water gauge pressure. A large reserve power in the turbine and capacity in the blower are thus shown by the tests made on the unit. Such facts, together with careful alignment on the heavy cast iron bed plate, and the thorough running test made before shipment, assure satisfactory service at destination.



It so happens that the first commercial unit sent out by the Kerr Turbine Company was made up of one of their turbines driving a No. 5 Sturtevant blower and installed for service in the Quebec (Canada) gas works. Other turbine driven blowers have been installed at the gas plant of the Consumers Gas Company, in Toronto. At this place a large increase in the capacity of the generators was reported due to the strong and steady pressure of air delivered by the turbin driven blower. Such facts indicate sharply the advantage in getting rid of losses due to slipping and breaking of belts in the old-fashioned method of driving. These turbine-driven gas blowers have been sent out, not only to Canada, but to England, Scotland, Mexico and various parts of the United States. So far as we know the service is uniformly satisfactory.

When to Install New Gas Machinery.

By "R."

The day of junk machinery is passed, and we are now in an age of improved machinery. Machinery for the operating of gas plants has passed through the same period of test that the machinery of railroads, machine shops, mills and other industrial institutions has encountered. The gas maker no longer goes to the second-hand dealer in gasholders, gas exhausters, meters, gas pumps, gas engines, gas pipes, gas pressure governors or other apparatus of the gas making and gas using business, with a view of getting superior apparatus. The second-hand apparatus is extremely useful to the party desiring to start business on a light scale with moderate cash, and in fact there are many second-hand gas manufacturing devices available of excellent pattern; but the general trend to-day is to invest in the best machinery possible to obtain. And much of the apparatus is condemned as out-of-date long before it is worn out. The remodelling of plants goes on without a stop. Some of the machinery cast aside seems almost like new, but the demand is for higher speed, greater production, more even products and more profitable results. Gas manufacturers have long since discovered that it pays to discard the old machine to make space for the new, because of the more economical processes of manufacture with the new.

Hence, when to install new machinery in the gas plant is often a question of importance. You can examine gasholders, gas pipes, tubes, boilers and other apparatus of the plant and find in them many flaws to justify the substitution of the old apparatus for new. Take the boiler plant, for example. In one engine room of a gas plant the writer observed boiler tubes in the condition shown in the cut. One was swelled out as at *A*, Fig. 1, which swelling thinned the metal at that point as well as caused a rupture liable to break. In Fig. 2, *B*, may be the probable result if the defect is allowed to run. Then, in another place I found a tube entirely out of commission, with the ends plugged, because of the broken places, *C* and *D*, Fig. 3. Fig. 4 shows some patches which were put on a tube in another place. Anyone can readily see that work of this nature is not right.

While the boiler in most instances can be forced on in its work, that tortured apparatus is handicapped and poor results follow. There is a loss of power. It is time to install new apparatus when the apparatus reaches this stage.

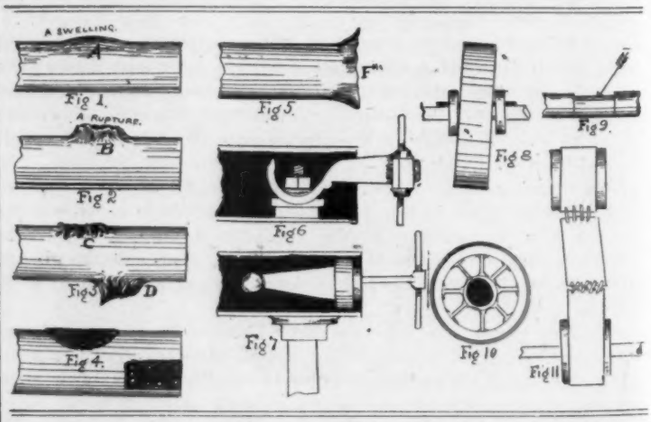
It is time to buy new tubes when the tubes become expanded at the ends, as at *F*, Fig. 5. It is possible to cut off the tube end and put on a new piece, and if this is done, the blacksmith of the plant should cut off the defective metal of the tube, and then scarf the end to receive the similarly scarfed end of the new piece to be welded on. Sometimes you have the tube or pipe to be cut while the tube or pipe is in position in a boiler or tank. A fine cutting device of a home-made design is exhibited in Fig. 6. The machinist can use any cutting tool and heat the steel so as to bend the metal to the curved form shown in the drawing. The curved piece is bored for the bolt that passes through the shoulder and rests in the pieces of steel of the pattern illustrated. A handle for turning purposes is fitted to the outer end of the instrument. This cutting tool is simply revolved within the pipe and the cutting edge turned against the inner side of the shell until the shell is cut through.

A device for expanding depressions in gas pipes and tubes is shown in Fig. 7. You can make one of these tools and press it forward into the pipe or tube to be pressed outward wherever the wall is pushed inward.

It is time to get new machinery for the gas plant when you find that the bearings of certain parts of the machine are worn and in a wobbly order. The day of economy by running old and worn journals is over.

I found one wheel of a blower poorly balanced on a shaft, with steel keys badly driven, as in Fig. 3. The blower had to be run at reduced speed. The shaft was worn as shown by the arrow in Fig. 9. This means that the time is near for a new blower. A new line of shaft right there would overcome the special defect in the shaft, but before many months of running some other defect would crop up. There are gas manufacturers who will strive to run indefinitely machinery with worn bearings. Other men will keep their plant up to the times by constantly casting out the imperfect and old apparatus to give room for the new. When it is done regularly every year the plant is kept up without much hardship; but when the plant is in a poor condition, due to neglect in keeping the machinery up to date for a period of years, the case is almost hopeless. In fact, some of the plants get so far run down that they are obliged to cease manufacturing until some enterprising man takes hold and invests enough money to put the plant in order to make gas according to modern economical principles.

I saw a gas pump idle due to the balance wheel hub becoming worn, as in Fig. 10, thereby allowing the wheel to get out of line. While some men are capable of boring out the worn portion and brazing in a new bushing, thereby making it possible to use the wheel for years, other men who tackle the job simply make a botch of it and the pump has to struggle along under difficulties. For this reason many superintendents prefer to buy new wheels, and sometimes new pumps outright, when the apparatus arrives at the worn order illustrated. Then, again, there are men who will make old belting run with patches, as in Fig. 11, even though the belt jumps, slips, wabbles and



does other things calculated to cause loss of time and annoyance. Other men will look ahead far enough to see that it pays to consign a slipping patched-belt to the junk heap and give the machine driven by it a new start with a new belt.

MR. T. R. WATSON is informed that Mr. W. A. Everson has been General Manager of the Hamilton (O.) Gas and Electric Company since the 1st inst.

[Continued from Page 109.]

REPORT OF PROCEEDINGS, FOURTH ANNUAL MEETING, AMERICAN GAS INSTITUTE.

Held in the Hall of Elks, Detroit, Mich., October 20, 21 and 22, 1909.

First Day—Morning Session.

REPORT OF COMMITTEE ON CALORIMETRY—*Continued.*

Graefe Calorimeters.

This calorimeter consists essentially of a metal cylinder holding a known quantity of water and a hole in the center for the admission of the gas burner. The metal cylinder has a core in the center forming an annular space between it and the outside shell that holds the water, one liter being the normal content. The gas burner, of a luminous flame type 1 inch high, is placed inside the core or center hole which is open both top and bottom to the air. A wire rod with screens is inserted inside the core for the purpose of baffling the heated current of air and product of combustion and allowing a better absorption of the heat by the inside walls of the calorimeter and the contained water.

A thermometer is inserted through a cork placed in the top of the annular space over the water, this thermometer is immersed in water which is kept in motion or is agitated occasionally by a stirring rod also inserted through the top cork.

No gas meter is provided with this calorimeter, but the gas is measured by being displaced by water from a graduated bottle holding something over 6 liters. This bottle acts both as a storage vessel and meter, and is provided with a device inserted in the mouth of the bottle, allowing for the escapement of gas and admission of the water, and also to remove the water and aspirate a sample of gas when it is refilled.

Methods of Testing.

The methods of testing these calorimeters were exactly similar to those adopted previously, and all thermometers and meters were carefully calibrated and corrections made for any inaccuracies. The comparative tests were made simultaneously, the gas supply, water supply and exhaust products from the calorimeter being maintained at approximately the temperature of the room.

Test of Sargent Calorimeters.

The Sargent calorimeters were tested first for the best position of the exhaust damper which determined the proportion of the air necessary for complete combustion. The second test was for the most efficient rate of combustion and the third test for comparative efficiency.

Best Position of Damper.

The Sargent calorimeters have at the exhaust vent a sliding damper upon which is scratched a scale having divisions about one-tenth of an inch apart. With this scale the damper can always be readily set to the same position which has been determined to give the highest reading of the heating value. In these tests the position of the damper has been designated as follows: At the division 0 the damper is wide open, and at the 20th division the damper is completely closed. A series of tests were made with the damper respectively at divisions 0, 10, 15 and 17.

The results of series A H show the relative indications of the heating value as given by the calorimeter with the damper set at different divisions. A subsequent series of tests of the effect of the position of the damper was made and the results of these tests are given in series A H. The results are uniformly low when the damper is wide open and the heating value increases as the damper is closed to the division 15. With the damper closed beyond this division there is not sufficient draught through the calorimeter, incomplete combustion results and the heating value drops very abruptly to a low figure.

The results of the series A F have not been plotted in the form of a curve because there were only two points determined, viz., with the damper wide open and the damper set at division 15. The results of series A H, as shown in the tabulated data, prove that low results are obtained with the damper wide open and the best results with the damper set at about division 15.

Most Efficient Rate of Combustion.

In the operation of every calorimeter there is a rate of combustion at which the calorimeter will give the highest heating value, everything else being equal. So in these tests, before any comparative tests were attempted, the rate of combustion at which the Sargent calorimeters would give the highest indication of the heating value of the gas, was determined. This series of tests has been called A J, and the results show that both the Sargent calorimeters give the maximum heating value with a rate of combustion equal to 6 cubic feet of gas per hour. There seems to be little difference, however, between the indications at the rates of 6 and 7 cubic feet per hour. See Plates XVII. and XVIII.

The results of these tests are shown in the tabulated data and in the accompanying curves, from which the most efficient rate of combustion can be readily deduced.

Comparative Efficiency Tests.

In determining the efficiency of these Sargent calorimeters it was decided to make comparative tests with the calorimeter whose efficiency had been determined by means of the electrical heater as described in the 1908 Report. So for this purpose the No. 872 Junkers was used whose ultimate efficiency had been proven to be slightly over 99.5 per cent.

All these instruments were operated at the same time and under exactly the same conditions as they were, such as would produce the most efficient and uniform results.

The average of nine tests was taken in each case, as one reading was spoiled in operating each calorimeter. The total average heating value of the Sargent No. 1 was 603.5 B.T.U. The Sargent No. 2 was 602.9 B.T.U., while the Junkers No. 872 showed and average of 602.1 B.T.U., which was afterward corrected to 602.7 B.T.U., due to a recalibration of the Junkers meter, which was proven against the ½ cubic foot bottle and found to be 1 per cent. fast.

This comparison gave evidence that both types of instruments had been so designed that with careful handling under certain prescribed directions the results obtained were identical and must certainly be near to the total available heat of the gas.

The Sargent calorimeters were open to some criticism because of certain mechanical features and careless workmanship. The body of the calorimeter was rather heavy, weighing about 23½ pounds, this excessive weight causing a sluggishness in the indications of the outlet thermometer. Several of the water channels throughout the instrument were choked with pieces of solder, some of which were shaken out, while others it was impossible to remove. One criticism of all the calorimeters and particularly so of the Sargent was, that the entire body of the instrument is soldered together, making it impossible to clean the inside of the instrument. Long usage has shown that it is desirable to be able to dismantle the calorimeter so that the various water channels may be cleaned. The post supporting the burner of the Sargent calorimeter was not made carefully enough to be sure of locating the burner in the center of the combustion chamber. Several low readings were obtained, due to the fact that the flame impinged on the side of the combustion chamber and was cooled so as to produce incomplete combustion.

Tests on the Graefe Calorimeter.

The Graefe calorimeter, as stated before, has no meter, but the gas is stored and measured in a bottle holding approximately 6 liters of gas and upon the side of the bottle a scale from 0–5 liters is etched. The graduations are to single liters. This bottle was calibrated against a wet test meter No. 437, made by the American Meter Company. The results of this calibration showed that it was impossible to read the large meniscus formed on the surface of the bottle with any accuracy, the results being:

0–1 liter bottle	=	.034	cubic feet.
1–2 "	=	.033	"
2–3 "	=	.033	"
3–4 "	=	.035	"
4–5 "	=	.0325	"

A true liter being .0353 + cubic foot, or an error from 3 to 7 per cent.

The burner furnished with this calorimeter gave a luminous flame and great care was necessary in placing the lighted burner in the calorimeter so that the flame did not touch the wire support for the gauze inside the combustion chamber. It was also observed that the flame would sometimes go out and immediately relight, and at the instant that the flame relighted it shot upward about an inch beyond its normal height, and at this point the flame would touch the gauze inside the combustion chamber and deposit a considerable amount of soot. After making several tests this luminous flame was discarded in favor of a non-luminous Bunsen.

The thermometer furnished with the Graefe instrument was an ordinary chemical thermometer, having a range from 0–95°, and

graduated to single degrees. Such a thermometer as this could at best give only very approximate results, and it was extremely difficult to observe any slight changes in the temperature of the water in the calorimeter. Several tests were made with this thermometer and then a Fahrenheit thermometer graduated from 0.1° was substituted and further tests made.

As stated in the prospectus and directions furnished with this instrument, the Graefe calorimeter must be standardized against some other standard calorimeter which will give the true heating value of the gas. For these tests, labeled series AN, the heating value of the gas was first determined by the Junkers calorimeter No. 872.

In this series readings were obtained of the total heating value of the gas, as well as the total heating value, less the latent heat of the condensed water formed in the products of combustion. This was deemed necessary, as the Graefe calorimeter does not in any case account for this latent heat, as the products of combustion pass off at such a temperature that none of the water vapors thus formed is condensed.

It is necessary to make tests on the Graefe calorimeter in a room that is free from draughts, and the operator must be careful not to move suddenly, because the small flame, which is only 1 inch high, is easily deflected from its natural course. It is apparent, also, that the water which is used in the calorimeter should be at room temperature.

The first tests made on the Graefe calorimeter were made with the burner furnished with the instrument and 5 liters of gas burned per test. After about 2½ liters of gas had been burned the flame began to flicker and would almost go out, then flare up high, burn steadily for a little while, and repeat the performance more frequently as the amount of gas approached 5 liters.

This flickering of the flame is due to the diminishing pressure with which the gas is forced through the burner. The water which displaces the gas from a bottle is delivered from a small cup above the bottle at a constant level, consequently, as the gas is forced out of the bottle the head of pressure is becoming less and, finally, there is not sufficient head to force the same quantity of gas through at 4½ liters as there was at the beginning of the test when the bottle was full of gas. Because of these irregularities with the operation of the Graefe calorimeter, when 5 liters of gas were burned per test, 2 liters of gas were burned for some of the subsequent tests. With this quantity of gas there was no difficulty in maintaining a steady flame, but upon burning the second 2 liters, say from the division 3 liters to division 5 liters, the cock regulating the water admitted for displacement of gas had to be regulated to give a greater quantity of water for displacement.

As shown in the curve of the series AN, tests Nos. 3, 4 and 5 are fairly close together. These tests were made with the calorimeter as it was purchased. Tests Nos. 6 and 11 were made on this calorimeter, using a non-luminous bunsen burner with a flame 3 cm. high and a thermometer graduated to 0.1° F. It is apparent from these later tests that there is a considerable variation in the indications of this instrument. There is a variation of 20 B.T.U.'s between the low and the high reading in tests Nos. 6–11.

Some tests were then made, using the non-luminous Bunsen and the thermometer graduated to 0.1° F., but burning 4 liters per test. The results for the tests 12 and 13 show that the indications of heating value with this arrangement are again lower, just as the indications with the original calorimeter outfit were low when 5 liters of gas were burned per test.

The directions furnished with the calorimeter state that the B.T. U. per cubic foot equals $\frac{M \times 142.5}{N}$. This supposes that the calorimeter is 79.3 per cent. efficient in the above equation. M equals the rise of temperature in degrees Centigrade and N signifies the liters of gas burned. Now, 1 liter of water = 2.204 pounds, 1 liter of gas = 0.035 cubic foot. Hence, the B.T.U. per cubic feet = $\frac{M \times 1.8 \times 2.204}{N \times 0.035 \times (X)}$, where X would equal the percentage that the heating value as given by the Graefe calorimeter is of the heating value as given by some standard calorimeter. The constant, 142.5, is derived from the last equation, supposing that X is equal to 0.973, which is the ratio of the heating value of the Graefe calorimeter and the heating value given by a standard calorimeter.

From tests shown in series AN the average heating value of the gas tested was 598.2, the value, deducting the latent heat of the products of combustion, was 558.5.

A reference to the tabulated data of the tests on the Graefe calorimeter series AN shows the exhaust temperature to be over 100° F. and in some cases reading as high as 150° F. This high temperature, with the naturally large excess of air admitted, will prevent the condensation of any water vapors formed during combustion and the latent heat of this water will never be taken into account by the calorimeter.

The efficiency or correction factor of the Graefe calorimeter as shown by the circular of instructions is .793, which, if applied to the heating value of the gas as shown in series AN tests 1 and 2, is

$$376.4 \div .793 = 474.6 \text{ B.T.U.}$$

if applied to tests 3 to 11 inclusive is

$$411.7 \div .793 = 519.2$$

and in tests 12 and 13

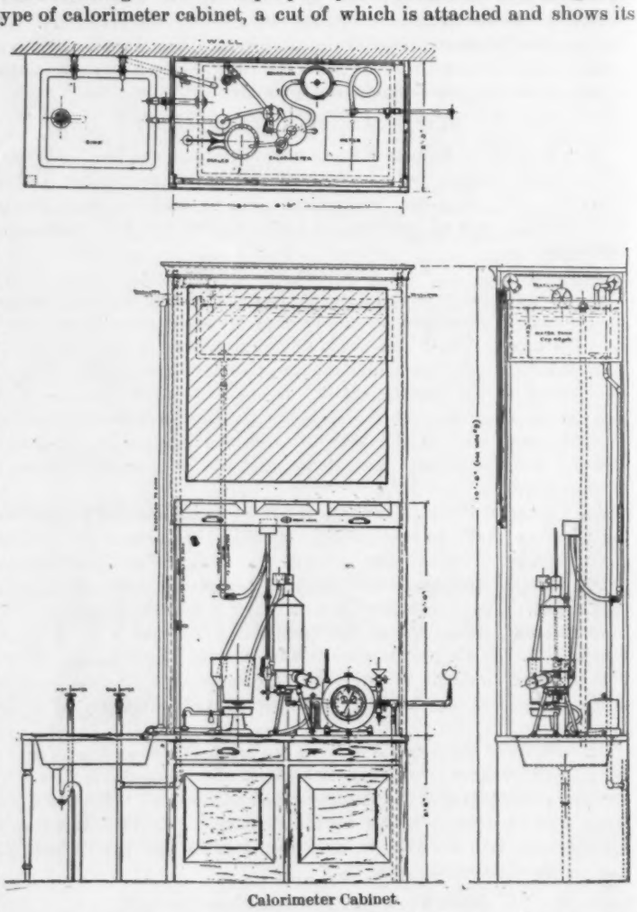
$$389.7 \div .793 = 491.4$$

If the total heating value of this sample of gas as read by the Junkers calorimeter of 598.2 is considered as a standard the results indicated by the Graefe instrument are only in the successive tests, from 79 per cent. to 87 per cent. of its true value and represent only from 85 per cent. and 93 per cent. of its low heating value.

Thus it is apparent that it is necessary to specify the amount of gas which has been burned for each test of the Graefe calorimeter. It appears that a small quantity of gas burned per test will give a higher indication of heating value than a larger amount of gas burned. The reason for this is easy to see, because the more gas that is burned the hotter the water in the calorimeter will become, and consequently the greater will be the radiation from the walls of the calorimeter, and greater will be the losses from products of combustion and entrained air.

Calorimeter Cabinet.

For the purpose of facilitating the use of the calorimeter for commercial purposes it is desirable that the instrument shall be permanently installed and always in a position to make quick and accurate readings. For this purpose your Committee has designed a type of calorimeter cabinet, a cut of which is attached and shows its



Calorimeter Cabinet.

general plan and usefulness. It can be installed in any laboratory or conveniently erected in the rear of any office. It provides for a supply of water at the temperature of the room, for a supply of gas

from some permanent selected source, and for a careful protection of all auxiliary instruments.

This cabinet should be made dust proof, and should always be kept closed and locked when not in use. High grade thermometers may then be used without risk of much handling or meddlesome interference.

The construction of such a cabinet should insure an operating company of having a calorimeter at all times ready for instant use.

Conclusions.

After this second year's investigation your Committee is convinced that the general instructions and precautions given in the report of 1908 are correct and need but little modification. A few words might be said, however, in regard to the general selection of calorimeters and measuring instruments.

With reference to the meter. The specifications for the gas meter as given in 1908 are to be commended. Further experience has shown that the meter with the internal overflow has been the cause of many eratic readings in some very important investigations. We recommend that this type of meter be discarded and only that with the exterior water gauge glass be used, and that the meters be calibrated and tested at the pressure and rate of flow at which they will be used.

With reference to thermometers. We recommend that great care be used in the selection of thermometers, and that the thermometers that are used in measuring the inlet and outlet water temperatures should be calibrated in every case. We would recommend for all commercial purposes the selection of thermometers in accordance with the desciption previously noted in this report.

The type of calorimeter to be used was described in last year's report, and the Committee has few remarks to make further on this point, except that it is preferable to have an instrument that is so made that the interior is accessible for cleaning purposes. After continual service with an impure water, there will be deposited mud or scale on the interior water channels, which will tend to decrease the efficieney and general accuracy of the calorimeter.

The placing of the thermometers on the same level is recommended, as in last year it has been shown that suitable calorimeters can be made with this design in view.

The Committee wishes to give all credit for the experimental work done in this investigation during the past year to Mr. O. L Kowalke, of the Chemical Engineering Department, of the University of Wisconsin.

This work has enabled us to extend the field of our investigation, as suggested in the 1908 report, and enables us to reaffirm last year's directions for the use of calorimeters. It clearly shows the relative effect of the several possible sources of error not covered by last year's work.

Respectfully submitted,

J. B. Klumpp,
R. B. Brown,
C. F. Burgess,
R. C. Cornish,
O. L. Kowalke,
} Committee.

Table 12.—*Series Z. Junkers No.* 872.

	1.	2.	3.	4.	5.	6.	7.
Barometer	28.84	28.84	28.84	28.84	28.84	28.84	28.84
Gas temperature	68.18	68.24	67.60	68.48	68.57	68.72	69.08
Correction factor	0.9402	0.9400	0.9423	0.9394	0.9391	0.9388	0.9378
Room temperature	70.0	70.0	69.6	70.0	70.0	70.3	71.0
Exhaust temperature	72.7	73.0	73.0	73.0	73.5	73.5	74.0
Gas rate, cubic feet per hour	6.97	6.90	6.92	6.92	6.92	6.92	6.92
Gas consumed, cubic foot	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Water heated, pounds	10.625	7.216	5.463	4.553	3.615	3.139	2.841
Inlet temperature	70.546	70.450	70.378	70.635	70.845	70.873	71.148
Outlet temperature	80.847	85.609	90.454	94.599	100.623	105.525	109.295
Difference, °F	10.301	15.159	20.245	23.633	29.778	34.652	38.147
B.T.U	581.8	581.9	582.1	580.8	581.0	579.3	577.7

Table 13.—*Series X. Junkers No.* 872.

	1-4.	5-8.	9-12	13-16.	17-20.	21-24.
Barometer	28.79	28.77	28.73	28.70	28.66	28.63
Temp. gas	69.4	68 35	67.8	67.7	68.1	68.15
Correction factor	0.9354	0.9374	0.9374	0.9366	0.9344	0.9328
Humidity, pr. ct.	62.0	62.0	62.0	75.0	88.0	100.0
Room temp	69.0	68.5	68.5	69.5	70.8	70.4
Exhaust temp	45.6	54.2	63.2	72.4	81.5	88.6
Gas rate, cu.ft.hr.	6.78	6.77	7.05	6.9	6.91	6.92
Gas consumed, ft.	0.2	0.2	0.2	0.2	0.2	0.2
Water heated, lb.	7.499	7.428	7.251	7.306	7.295	7.255
Inlet temp. "C."	3.894	9.585	15.352	21.304	26.765	31.819
Outlet temp. "C."	12.496	18.098	23.953	29.844	35.259	40.132
Difference, °F	15.482	15.279	15.518	15.385	15.289	14.972
B.T.U	620.2	608.2	601.2	600.2	596.8	582.1

Table 14.—*Series AA. Junkers No.* 872.

	1.	2.	3.	4.
Barometer	29.06	29.04	29.04	29.00
Temperature, gas	68.4	68.2	68.0	67.82
Correction factor	0.9466	0.9469	0.9466	0.9465
Humidity	40.0	49.0	56.0	68.0
Room temperature	70.0	69.5	69.0	69.0
Exhaust temperature	72.5	73.0	72.5	72.5
Gas rate, cubic feet hour	6.79	6.80	6.80	6.80
Gas consumed, cubic feet	0.2	0.2	0.2	0.2
Water heater, pounds	8.113	8.102	8.107	8 11
Inlet temperature	70.481	70.715	70.456	70.624
Outlet temperature	84.450	84.734	84.480	84.634
Difference	13.969	14.019	14.024	14.010
B.T.U	598.5	599.5	600.3	600.5

Table 15.—*Series AJ. Sargent No.* 1.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
Barometer	29.10	29.10	29.10	29.10	29.10	29.10	29.12	29.10	29.10	29.10	29.10
Temperature of gas	78.26	78.26	78.26	78.44	78.44	78.44	78.44	78.98	78.98	78.8	79.25
Correction factor.	0.9218	0.9218	0.9218	0.9215	0.9215	0.9215	0.9222	0.9200	0.9200	0.9224	0.9192
Temperature of room	81.0	81.0	81.0	81.0	81.0	81.0	81.0	82.0	82.0	82.0	82.0
Temperature, exhaust	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.5	79.0	79.0	79.0
Rate of gas, cubic feet hour	3.05	3.00	3.00	3.91	3.89	3.91	3.91	5.07	5.07	5.10	5.95
Gas consumed, cubic feet	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2
Water heated, liters	3.592	3.605	3.610	3.705	3.690	3.680	3.709	7.260	7.260	7.257	7.175
Inlet temperature	77.592	77.592	77.607	77.770	77.793	77.809	77.844	77.943	77.963	77.973	78.007
Outlet temperature	92.739	92.677	92.703	92.449	92.557	92.647	92.583	93.973	92.987	93.010	93.255
Difference	15.147	15.085	15.096	14.679	14.764	14.838	14 739	15.030	15.024	15.037	15.248
B.T.U	590.2	590.0	591.1	590.3	591.4	592.5	592.9	593.0	592.8	591.5	505.0

	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.
Barometer	29.10	29.10	29.09	29.09	28.08	29.08	29.08	29.08	29.08	29.08	29.08
Temperature of gas	79.19	79.16	79.88	79.34	29.34	79.52	79.52	79.34	79.25	79.25	79.25
Correction factor.	0.9193	0.9193	0.9171	0.9187	0.9184	0.9177	0.9177	0.9184	0.9185	0.9185	0.9185
Temperature of room.	82.0	82.0	82.0	82.0	82.0	82.0	82.0	82.0	82.0	82.0	82.0
Temperature, exhaust	79.0	79.0	79.0	79.0	79.0	80.0	79.0	79.0	79.0	79.0	79.0
Rate of gas, cubic feet hour	6.0	5.96	6.79	6.85	6.85	8.14	8.09	8.09	9.0	9.0	9.0
Gas consumed, cubic feet	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Water heated, liters	7.155	7.148	7.098	7.083	7.090	7.049	7.049	7.045	6.808	6.825	6.810
Inlet temperature	78.014	78.014	78.074	78.074	78.094	78.075	78.021	77.994	77.883	77.873	77.844
Outlet temperature	93.256	93.265	93.422	93.419	93.445	93.522	93.423	93.426	93.684	93.584	93.625
Difference	15.242	15.251	15.348	15.345	15.351	14.447	15.402	15.432	15.801	15.711	15.781
B.T.U	593.1	592.9	593.9	591.5	592.5	593.2	591.5	591.9	585.5	583.7	585.0

TABLE 16.—*Series AJ. Sargent No. 2.*

	1.	2.	3.	4.	5.	6.	7.	8.
Barometer	29.10	29.10	29.10	29.10	29.10	29.10	29 12	29.10
Temperature of gas	78.26	78.26	78.26	78.44	78 44	78.44	78.44	78.98
Correction factor	0.9218	0.9218	0.9218	0.9215	0.9215	0.9215	0.9222	0.9200
Temperature of room	81.0	81.0	81.0	81.0	81.0	81.0	82.0	81.5
Temperature of exhaust	79.0	79.0	79.0	79.0	79.0	79.0	80.0	79.5
Rate of gas, cubic feet hour	2.91	2.92	2.92	3.86	3.87	3.87	4.98	5.0
Gas consumed, cubic feet	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2
Water heated, pounds	3.658	3.641	3.666	3.645	3.655	3.655	7.345	7.327
Inlet temperature	77.610	77.590	77.623	77.769	77.810	77.828	77.952	77.980
Outlet temperature	92.691	92.671	92.681	92.954	92.947	92.978	93.031	93.049
Difference	15.081	15.081	15.058	15.185	15.137	15.150	15.079	15.069
B.T.U	598.4	595.6	598.8	600.6	600.3	600.9	600.4	600.0

	9.	10.	11.	12.	13.	14.	15.	16.
Barometer	29.10	29.10	29.10	29.10	29.10	29.09	29.09	29 08
Temperature of gas	78.98	78.80	79.25	79.16	79.16	79.88	79.34	79.34
Correction factor	0.9200	0.9224	0.9192	0.9193	0.9193	0.9171	0.9187	0.9184
Temperature of room	81.5	81.5	81.5	81.7	82.0	82.0	82.0	82.0
Temperature of exhaust	79.5	79.5	79.5	79.7	79.5	80.7	80.0	79.8
Rate of gas, cubic feet hour	5.0	5.0	5.86	5.78	5.80	6.66	6.74	6.66
Gas consumed, cubic feet	0.2	0.2	0.2	0 2	0.2	0.2	0.2	0.2
Water heated, pounds	7.319	7.337	7.443	7.375	7.352	7.353	7.370	7.335
Inlet temperature	77.991	78.011	78.036	78.031	78.031	78.091	78.091	78.091
Outlet temperature	93.087	93.089	92.952	93.041	93.036	93.109	93.093	93.103
Difference	15.087	15.089	14.916	15.010	15.005	15.018	15.002	15.012
B. T. U	600.1	600.1	603.8	601.5	600.0	602.0	601.7	599.4

	17.	18.	19.	20.	21.	22.	23.
Barometer	29.08	29.08	29.08	29.08	29.08	29.08	29.08
Temperature of gas	79.52	79.52	79.34	79.25	79.25	79.25	79.25
Correction factor	0.9177	0.9177	0.9184	0.9185	0.9185	0.9185	0.9185
Temperature of room	82.0	81.5	81.0	81.0	81.0	81.0	80.7
Temperature of exhaust	79.8	80.0	80.0	80.0	80.0	80.0	80.0
Rate of gas, cubic feet hour	6.66	8.27	8.18	8.21	8.78	8.88	8.78
Gas consumed, cubic feet	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Water heated, pounds	7.361	7.416	7.419	7.427	7.128	7.130	7.128
Inlet temperature	74.091	78.091	78.031	78.000	77.911	77.880	77.840
Outlet temperature	93.131	92.970	92.922	92.858	93.356	93.301	93.271
Difference	15.040	19.879	14.891	14.858	15.445	15.421	15.431
B. T. U	603.1	601.1	601.4	600.7	599.3	598.5	598.7

TABLE 17.—*Series AH. Sargent No. 1.*

	1.	2.	3.	4.	5.	6.	7.	8.
Barometer	29.16	29.16	29.16	29.16	29.16	29.16	29.16	29.16
Temperature of gas	75.38	75.56	75.56	75.56	75.74	75 74	75.74	75.74
Correction factor	0.9321	0.9314	0.9314	0.9314	0.9308	0.9308	0.9308	0.9308
Temperature of room	78.0	78.0	78.0	78.4	78.5	78.5	78.5	78.5
Temperature of exhaust	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0
Rate of gas, cubic feet hour	5.10	5.10	5.12	5.12	5.10	5.10	5.12	5.14
Gas consumed, cubic feet	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Water heated, pounds	7.511	7.502	7.498	7.500	7.502	7.494	7.481	7.480
Inlet temperature	75.766	75.796	75.859	75.885	75.921	75 96	76.010	76.054
Outlet temperature	90.733	90.770	90.832	90.859	90.942	90.911	89.822	89.865
Difference	14.967	14.984	14.973	14.974	15.021	14.951	13.812	13.811
B.T.U	603.0	603.4	602.6	602.9	605.3	601.9	555.0	554.9
Damper at division	0.00	0.00	10.00	10.00	15.00	15.00	17.00	17.00

TABLE 18.—*Series AH. Sargent No. 2.*

	1.	2.	3	4.	5.	6.	7.	8.
Barometer	29.16	29.16	29.16	29.16	29.16	29.16	29.16	29.16
Temperature of gas	75.38	75.56	75.56	75.56	75.74	75.74	75.74	75.74
Correction factor	0.9321	0.9314	0.9314	0.9314	0.9308	0.9308	0.9308	0.9308
Temperature of room	78.0	78.0	78.0	78.0	78.2	78.4	78.0	78.0
Temperature of exhaust	77.5	77.5	77.5	77.5	77.5	77.5	77.5	77.3
Rate of gas, cubic feet hour	5.0	5.02	5.0	5.0	4.98	4.98	5.0	5.0
Gas consumed, cubic feet	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Water heated, pounds	7.562	7.564	7.583	7.582	7.591	7.593	7.580	7.581
Inlet temperature	77.760	75.80	75.841	75.881	75.917	75.950	76.000	76.036
Outlet temperature	90.793	90.82	90.877	90.858	90.958	90.932	88.365	88.357
Difference	15.033	15.02	15.036	14.977	15.041	14.982	12.365	12.321
B.T.U	609.8	609.8	612.0	609.5	617.6	611.0	503.4	496.3
Damper at division	0.00	0.00	10.00	10.00	15.00	15.00	17.00	17.00

TABLE 19.—*Series AM. Junkers No. 872.*

	1.	2.	3.	4.	5.	6.	7.	8.	9.
Barometer	28.96	28.96	28.96	28.96	28.96	28.96	28.96	28 96	28.96
Temperature of gas	77.36	77.36	77.54	77.54	77.90	77.90	77.90	78.08	78.26
Correction factor	0.9198	0.9198	0.9195	0.9195	0.9185	0.9185	0.9185	0.9179	0.9172
Temperature of room	79.5	79.5	79.5	79.5	79.5	80.5	80.5	80.5	80.5
Temperature of exhaust	82.0	82.0	82.0	82.0	82.0	82.0	82.0	82.0	82.0
Rate of gas, cu. ft. hr	6.92	6.92	6.92	6.92	6.92	6 91	6.00	6.92	6.92
Gas consumed, cu. ft	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Water heated, pounds	7.383	7.368	7.393	7.399	7.394	7.396	7.397	7.400	7.410
Inlet temperature	79.898	79.977	79.998	80.028	80.058	80.079	80.079	80.129	80.179
Outlet temperature	94.927	95.011	94.985	95.008	95.036	95.021	95.015	95.044	95.078
Difference	15.029	15.034	14.987	14.980	14.978	14,942	14.936	14.915	14.899
B.T.U	603.4	602.1	602.4	602.7	602.8	601.5	601.4	601.2	601.8

Average for 9 tests = 602.1 B.T.U. Correcting for .1 per cent. meter error = 602.7 B.T.U.

TABLE 20.—*Series AM. Sargent No. 1.*

	1.	2.	3.	4.	5.	6.	7.	8.	9.
Barometer	28.96	28.96	28.96	28.96	28.96	28.96	28.96	28.96	28.96
Temperature of gas	77.36	77.36	77.54	77.54	77.90	77.90	77.90	78.08	78.26
Correction factor	0.9198	0.9198	0.9195	0.9195	0.9185	0.9185	0.9185	0.9179	0.9198
Temperature of room	79.5	79.5	80.0	80.0	80.5	80.5	80.5	80.5	81.0
Temperature of exhaust	81.0	81.0	81.0	81.0	81.0	81.0	81.0	81.0	81.0
Rate of gas, cu. ft. hr	5.92	5.94	5.90	5.90	5.92	5.94	5.94	5.94	5.94
Gas consumed, cu. ft	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Water heated, pounds	7.288	7.299	7.295	7.308	7.302	7.291	7.287	7.274	7.283
Inlet temperature	79.980	80.030	80.070	80.100	80.120	80.130	80.177	80.211	80.240
Outlet temperature	95.167	95.237	95.264	95.284	95.318	95.323	95.346	95.390	95.448
Difference	15.187	15.207	15.194	15.184	15.198	15.193	15.169	15.179	15.208
B.T.U	601.7	603.3	602.7	603.4	604.1	602.7	601.7	601.4	602.0

Average for 9 tests = 602.5 B.T.U.

TABLE 21.—*Series AM. Sargent No. 2.*

	1.	2.	3.	4.	5.	6.	7.	8.	9.
Barometer	28.96	28.96	28.96	28.96	28.96	28.96	28.96	28.96	28.96
Temperature of gas	77.36	77.36	77.54	77.54	77.90	77.90	78.08	78.08	78.26
Correction factor	0.9198	0.9198	0.9195	0.9195	0.9185	0.9185	0.9179	0.9179	0.9172
Temperature of room	79.5	79.5	79.5	79 5	80.5	80.5	80.5	80.5	80.5
Temperature of exhaust	81.0	81.0	81.0	81.0	81.0	81.0	81.0	81.0	81.0
Rate of gas, cu. ft. hour	5.85	5.85	5.80	5.80	5.80	5.77	5.77	5.77	5.77
Gas consumed, cu. ft	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Water heated, pounds	7.397	7 415	7.457	7.457	7.496	7.531	7.531	7.543	7.564
Inlet temperature	77.990	80.020	80.040	80.085	80.117	80.120	80.170	80.220	80.220
Outlet temperature	94.970	94.972	94.928	94.948	94.888	94.841	94.832	94.895	94.887
Difference	14.980	14.952	14.888	14.863	14.771	14.721	14.662	14.675	14.667
B.T.U	602.3	602.7	603.7	602.7	602.1	603.5	601.4	602.9	604.7

Average for 9 tests, 602.9.

TABLE 22.—*Series AN.—Junkers No. 872.*

	1.	2.	3.	4.	5.		1.	2.	3.	4.	5.
Barometer	29.02	29.02	29.02	29.02	29.02	Cubic feet of gas used.	0.2	0.2	0.2	0.2	0.2
Temperature of gas	78 26	78.44	78.62	78.80	78.98	Weight water heated.	7.335	7.330	7.347	7.338	7.344
Correction factor	0.9192	0.9189	0.9183	0.9190	0.9173	Temp. water inlet	78.567	78.646	78.670	78.715	78.772
Room temperature	80.0	80.0	81.0	81.5	81.5	Temp. water outlet	93.543	93.620	93.644	93.681	93.749
Exhaust temperature.	81.0	81.0	81.0	81.0	81.0	Rise in temperature	14.976	14.074	14.974	14.966	14.977
Rate of gas consumed.	6.92	6.92	6.92	6.94	6.92	B.T.U	597.5	597.2	598.9	598.1	599.5

Average B.T.U., 598.2.
Condensed water per cubic foot, 16.4 c.c.
Average heating value, less latent heat of products of combustion condensed, 558.5.

TABLE 23.—*Series AN.—Graefe Calorimeter.*

	1.	2.	3.	4.	5.	6.
Barometer	29.02	29.02	29.02	29.02	29.00	29.00
Temperature of gas	78.54	78.0	79.5	79.0	80.4	80.0
Room temperature, degs. F.	81.5	81.5	81.0	81.0	81.0	81.0
Exhaust temperature, degs. F.	137.0	159.5	....	120.0	128.0	116.0
Height flame, cm	3.0	3.0	3.0	3.0	3.0	3.0
Gas consumed, liters	5.0	5.0	2.0	2.0	2.0	2.0
Water heated	1,000	1,000	1,000	1,000	1,000	1,000
Initial temperature	26.70° C.	24.80° C.	25.0° C.	25.0° C.	25.0° C.	25.01° C.
Final temperature	43.00° C.	42.00° C.	32.3° C.	32.4° C.	32.3° C.	32.05° C.
Rise of temperature	16.30° C.	17.20° C.	7.3° C.	7.4° C.	7.3° C.	7.49° C.
B. T. U	366.4	386.5	410.1	410.7	410.3	421.0

Used luminous flame.

	7.	8.	9.	10.	11.	12.	13.
Barometer	29.00	29.00	29.00	29.00	28.98	28.98	28.98
Temperature of gas	80.8	80.8	80.9	80.9	81.0	81.0	81.0
Room temperature, degs. F.	81.0	81.0	81.0	81.0	81.0	81.0	81.0
Exhaust temperature, degs. F.	124.0	123.0	....	116.0	121.0	123.0	150.0
High flame, cm	3.0	3.0	3.0	3.0	3.0	4.0	4.0
Gas consumed, liters	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Water heated	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Initial temperature	80.73° F.	80.73° F.	80.83° F.	80.96° F.	81.08° F.	81.303° F.	81.584° F.
Final temperature	93.54° F.	93.59° F.	94.25° F.	93.935° F.	94.627° F.	106.690° F.	106.126° F.
Rise of temperature	12.81° F.	12.86° F.	13.42° F.	12.975° F.	13.545° F.	25.387° F.	24.542° F.
B. T. U	400.0	401.5	419.0	405.1	422.9	396.3	383.1

Used non-luminous flame.

NOTES REGARDING CONSTRUCTION AND OPERATION OF CALORIMETER CABINET.

The sketch represents a typical calorimeter cabinet, suitable for use in wareroom or shop or rear of gas office, and of such design that the calorimeter when once placed and connected up may be kept clean and safe and ready for use at all times.

The construction of cabinet should be as dust tight as practical. Where there is not enough head room for vertical sliding door, horizontal sliding or folding doors may be substituted. For lower ceilings the cabinet should be made as high as possible, keeping tank in same relation to top of cabinet as shown, and sliding door can be made in two parts, divided horizontally and hung like double sash in a window. Sides of cabinet are shown with glass to enable the interior to be well lighted.

The cabinet may be easily constructed with sink and water supply on either side, and calorimeter may be placed in any position to suit the observer.

Gas supply line to calorimeter should have purging gas jet continually burning, so that a fresh sample of gas may always be obtained. This jet may be conveniently placed as shown to assist in lighting cabinet. Do not place this light inside of cabinet.

Where city water contains scale or dirt, distilled water may be used over and over again. This is conveniently done by placing a receiving tank in base of cabinet. After readings are made pump this water back to overhead tank.

Overhead water tank should be refilled immediately upon finishing any one set of readings, so that the water may have an opportunity

to approach the temperature of the operating room before another set of readings is taken.

This cabinet is adapted to any similar type of calorimeter, and arrangements may be made for measuring the water instead of weighing it. All cocks controlling gas and water supply should be inside of cabinet and cabinet should be kept closed and locked when not in service.

The President—You have heard the report of the Committee on Calorimetry. What action shall be taken?

Mr. McDonald, of Louisville—I move that it be approved and the Committee continued.

The motion was seconded and carried.

The President—Next we have the report of the

Delegates to the International Pipe Thread Conference.

Mr. R. B. Brown—Mr. President and Gentlemen: On behalf of the Delegates to the International Pipe Thread Conference, I submit the following brief summary of the work which has been done since last year's meeting. Our delegates found it very difficult to make the foreign delegates to the congress see any good, sound reason for our fractional pitches; 11½ threads, for instance, is the thing they seem to have struck the hardest on. The foreign delegates also believe that the 6-thread pitch in a number of sizes is too large, cutting too much out of the thickness of the pipe. The Technical Committee would suggest to the Institute that it authorize the President to appoint an American member of the Committee with the view to carrying out the suggestions and recommendations of our delegates to the last congress.

International Unification of Pipe Threads.

To the Chairman of the Technical Committee, American Gas Institute—Sir: We have now the honor to submit our report showing the progress of the Commission organized by La Société Technique de l'Industrie du Gaz en France for the International Unification of Pipe Threads for Gas Appliances.

To this end, we append a Memorandum by Mr. Vander Willigen, giving a somewhat detailed account of the work of the second Congress in Paris on June 8, 9 and 10, 1909. Mr. Vander Willigen's Memorandum is accompanied by seven appendices, and a blue print.

Through the courtesy of Mr. Laurence V. Benét, delegate of the American Society of Mechanical Engineers and Hon. Vice-President of the Congress, we are also able to include his valuable report of July 13, 1909, to the American Society of Mechanical Engineers.

Summary and Conclusions.

1. *Profile and Taper of Thread.*—With regard to Profile and Taper of Thread, it will be seen that the American Briggs system has been completely accepted; hence, *full effect has been given to Paragraph 1 of the Resolutions adopted at the last meeting of the American Gas Institute.*

2. *Diameters.*—Although supported by the influential delegate of the American Society of Mechanical Engineers, we have thus far been unable to obtain the modifications in diameters, which were recommended in Paragraph 2 of our Resolutions, in order to make the proposed international sizes interchangeable with existing American standard diameters. Indeed, the situation in this respect is now less favorable than last year, for the 17 mm. size has been reduced to 16.5 mm. and the 60 mm. size has been reduced to 59.5 mm., making them no longer interchangeable with ¾-inch and 2-inch pipes respectively. This question is further complicated by the fact that the Commission has adopted the new British *principle* of "gauge diameters," without an exact and specific definition of "gauge diameter" as applied to the proposed International System.

3. *Pitches.*—The Commission has finally decided upon a pitch of 2.30 mm. (11 threads per inch) for diameters from 33 mm. to 114 mm. inclusive, thereby adopting the British standard, instead of the American pitches of 11½ threads per inch from 1 inch to 2 inches, and 8 threads per inch from 2½ inches to 4 inches.

4. In view of the sound arguments to that end of the majority of the Commission, and of the wish of the National Tube Works to reduce the pitch of these larger pipes (see page 2 of the Report of the Delegate of the A. S. M. E.), your delegates recommend that the pitches as adopted by the Congress be conditionally approved by the American Gas Institute, and that the entire American influence be concentrated upon securing, as far as possible, *diameters* that will be interchangeable with our Briggs standards.

5. It is important that the American case should be presented forcibly and positively at the next meeting of the Commission; so, to that end, we advise that a third member, resident in America, be added our delegation (or, as it would then be, *Committee*), who could cooperate with the Committee on Pipe Threads of the A. S. M. E. and consult with the leading pipe manufacturers. Your "foreign" delegates (if continued) would then be correctly instructed as to the "irreducible minimum" of the position they should maintain at the conferences.

Respectfully submitted,

A. G. Glasgow, } Delegates.
T. A. V. Willigen, }

[Mr. Vander Willigen's Memorandum and Appendices, together with Mons. Benét's report and the other exhibits connected with this subject, will be kept on file at Institute headquarters.]

Mr. McDonald, Louisville—I move that the in-coming President of the Association be requested to appoint the committeeman suggested by the delegates.

The President—You will have to move the acceptance of the report.

Mr. McDonald—I also move the acceptance of the report. [The motion was seconded and carried.]

The President—Next is the

Report of the Trustees of the Gas Educational Fund,

Mr. A. E. Forstall, Secretary. Will Mr. Walton Forstall read the report?

Mr. Walton Forstall then read the report as follows:

To the Subscribers to the Trustees Gas Educational Fund—Gentlemen: The Trustees appointed at the 26th annual meeting of the American Gas Light Association, held October 17, 1898, to administer the Educational Fund formed by your subscriptions, submit the following report as to the work done from October 1, 1908, to September 30, 1909:

As was noted in the last report most of these subscriptions previously in force expired with the beginning of the year covered by this report. The Trustees regret that in spite of a number of personal appeals and a general appeal contained in a circular letter addressed to all the active members of the American Gas Institute, they have not been able to secure a renewal of all of these expiring subscriptions, and that there has not been secured an amount of new subscriptions sufficient to meet the full cost of carrying on the work of the Correspondence Class during the year. It has, therefore, been necessary to draw on the Surplus Fund accumulated in previous years to the extent of $498.27. It is to be hoped that further subscriptions will be made and that in the next year it will be possible to add to the Surplus Fund instead of depleting it.

The idea of building up this Surplus Fund has been that in the course of time it would become large enough for the income derived from it to meet the expenses of the work and thus render it unnecessary for the Trustees to seek new subscriptions every few years. It is desirable, therefore, that in addition to the subscriptions for current expenses subscriptions should be made direct to the Surplus Fund, so that this can be built up more readily than if it depends solely upon the unexpended balances of subscriptions for current expenses.

The publication of the volume containing all of the answers sent out to the different sections of the class has proceeded more slowly than was estimated at the beginning of the year on account of the careful checking of proof both by the Secretary and by the Chairman. The matter is practically all in type, however, and unless further unexpected delay occurs the book should be issued before the beginning of 1910.

During the year 18 members of the Section of 1909 finished their course and their connection with the class ceased, while the Section of 1912 started work on January 1, 1909, with a membership of 48.

The number of members in each Section at the beginning of the year, the changes that have taken place during the year, and the names of the members of the class who have completed the course during the year, are shown in detail on the Secretary's report, which is appended.

The Section of 1910 now contains 23 members, the Section of 1911 29, and the Section of 1912 51, making the total membership in the regular class 103. Five special students are receiving the questions and answers with the Section of 1912.

The card index of the principal articles published in the American Gas Light Journal, *Progressive Age* and the *Journal of Gas Lighting* has been kept up during the year.

It may be advisable to remind the subscribers that at the office of the Secretary, No. 58 William street, there is a room conveniently located in the downtown business district, which is available for their use in case, when visiting New York, they wish to arrange for meeting friends or business associates at some place other than their hotel.

The Treasurer's report, which is appended, shows the total amount of subscriptions to date, the available income and expense for the year, a summary of the cash account and the statement of the amount of the surplus fund and the securities in which it has been invested.

The Surplus Fund is made up of a contribution of $2,000, of subscriptions paid in in advance of the time when they are due, of unexpended balances and of interest received on investments. The proper proportion of the advance subscriptions will, of course, be drawn out each year to meet expenses, but the unexpended balances and the interest will accumulate into a fund which will be available to assist in carrying on the work in case all the present subscriptions are not renewed when they expire.

Respectfully submitted, Trustees Gas Educational Fund.

WALTON CLARK, Chairman.
A. E. FORSTALL, Secretary.

SECRETARY'S REPORT FOR YEAR ENDING SEPT. 30, 1909.

	Sec. of 1909.	Sec. of 1910.	Sec. of 1911.	Sec. of 1912.	Special 1911.	Class 1912.	Total
Members enrolled Oct, 1, 1908.....	19	33	49	..	4	..	105
Entered Class Jan. 1, 1909	..	..	..	48	..	1	49
Additions to Class since Jan. 1, 1909.	..	..	..	38	..	4	42
	19	33	49	86	4	5	196
Resigned since Oct. 1, 1908...		1	2	6		9	
Dropped for non-receipt of answer since Oct. 1, 1908	1	9	18	29	4	61	
Finished course during year.....18						18	
	19	10	20	35	4		88
Total enrollment Sept. 30, 1909	..	23	29	51	..	5	108
Applications on file for admission to class Jan. 1, 1910.....							26

Names of Students who Completed the Three Years' Course with the Section of 1900.

T. S. Barlow, New York City.	A. A. DeLinde, Chicago, Ills.
R. Bickford, Syracuse, N. Y.	H. F. Melvin, Chicago, Ills.
C. F. Brunt, Waterloo, N. Y.	E. D. Minard, Newark, N. J.
F. C. Butler, Portsmouth, N. H.	S. B. Palmer, Boston, Mass.
W. C. Cocker, Ardmore, Pa.	J. V. Perry, Charlottesville, Va.
R. A. Fancy, Newton, Mass.	D. E. Robinson, Philadelphia, Pa.
W. R. Goudy, South Bend, Ind.	W. Sturdevant, Philadelphia, Pa.
M. C. Hancock, Rockford, Ills.	G. Wehrle, Chattanooga, Tenn.
G.M. Harrison, White Plains, N.Y.	C. O. G. Witmer, Des Moines, Ia.

REPORT OF W. R. BEAL, TREASURER, FOR THE FISCAL YEAR ENDING SEPT. 30, 1909.

Condition of Subscriptions.

		For Year 1908-1909.
Total old subscriptions holding over from second 5-year period	$753.00	$344.00
Total new subscriptions received for third 5-year period since Sept. 30, 1908.....	17,540.00	3,283.00
	$18,293.00	$3,627.00
Received from subscribers since Sept. 30, 1908 ...	$6,442.00	
Payments not applicable to year..	3,199,00	
Total paid in by subscribers since Sept. 30, 1908, and available for year.....	$3,243.00	
Paid in previous to current year on account of 1908-1909 subscriptions	244.00	
Total paid in by subscribers available for this year.	$3,487.00	
Still to be paid for this year.....	140.00	
Total subscriptions available for year.....		$3,627.00
Dues received for membership in Special Class...		25.00
Total amount available for year		$3,652.00

Statement of Income and Expense.

Total amount available for year.....		$3,652.00
Expenses.		
Secretary's salary	$3,000.00	
Office rent	300.00	
Printing, stationery, postage, etc.....	784.01	
Periodicals and binding	38.48	
Fire insurance on books.....	13.03	
Total expenses for year		$4,135.52
Deficit on current expenses.....		$483.52
Depreciation on furniture.....		14.75
Total deficit on year's operation.....		$498.27

Cash Account.

Received from subscribers since Sept. 30, 1908, Current Fund	$5,442.00	
Received from subscribers since Sept. 30, 1908, Surplus Fund	1,000.00	
Interest on securities owned as scheduled under heading "Surplus Fund".....	310.00	
Interest on deposits in bank.....	96.09	
Dues received for membership in Special Class...	25.00	
Payment in advance for "Catechism of Central Station Gas Engineering in the United States...	$20.00	
Total receipts for year	$6,803.09	
Cash balance from last year.....	2,562.74	
Total to account for.....		$9,455.83
Expenses for year paid.....	$4,135.52	
Expenses for previous year paid..	49.42	
Omaha Gas Co. 1st Mtg. 5 per cent. bonds.....	1,000.00	
Furniture (extension to files and cases for same)..	30.00	
Cuts for volume of questions and answers.....	14.13	
Total paid out		$5,229.37
Balance		$4,226.46
Balance in Knickerbocker Trust Co., as per pass book.....	$1,721.37	
Balance in Guaranty Trust Co., of New York, as per pass book, less checks unpaid.....	2,505.09	
		$4,226.46

Publication Account.

Receipts—		
For payments made in advance for copies of "Catechism of Central Station Gas Engineering in the United States".....	$20.00	
Expenditures—		
Cuts to illustrate book.....	14.43	
Balance.....		$5.57

Surplus Fund and Investment.

Amount paid in by subscribers in advance	$2,438.00	
Amount paid in by subscribers to Surplus Fund..	2,000.00	
Unexpended balances previously reported (after deduction of amount $55, of subscriptions previously included, but cancelled later; see minutes meeting, Oct. 8, 1907)	4,499.79	
Unexpended balance from 1907-1908 (after deduction of amount $40, of subscriptions previously included but cancelled later; see minutes of meeting, Oct. 8, 1907).....	450.11	
Interest on bonds to date.....	2,257.22	
Interest on deposits in bank.....	378.25	
		$12,023.37

Already Invested.

$2,000 Binghamton Gas Works, 1st mortgage 5 per cent. bonds.....	$1,930.00	
$1,500 Atchison, Topeka & Santa Fe R. R. general mortgage 5 per cent. bonds.....	1,513.75	
$2,000 Omaha Gas Company 1st mortgage 5 per cent. bonds	2,000.00	
$1,500 New Gas Light Company, of Janesville, 1st mortgage 4 per cent. bonds (guaranteed by the United Gas Improvement Company).	1,500.00	
Furniture	140.46	$7,084.21
		$4,939.16
Balance of publication account		5.57
		$4,944.73

NEW YORK, Oct. 15, 1909.

We, the undersigned members of the Finance Committee of the Trustees Gas Educational Fund, have this day examined the books and accounts of Wm. R. Beal, Treasurer, for the year ending Sept. 30, 1909, and have found the same to be correct, and the above balance of $4,226.46 to be in bank. A. C. HUMPHREYS, } Finance
W. F. DOUTHIRT, } Committee.

The President—You have heard the report of the Trustees. What action will you take upon it?

The motion was made, seconded and carried that the report be accepted.

The President—Next is the Report of the Committee on Beal Medal. Are they ready to report? Mr. Perkins is the Chairman. [No response.]

The President—Next is

REPORT OF COMMITTEE ON PIPE STANDARDS.

Mr. R. B. Brown—The Committee on Pipe Standards will not make a report. On behalf of Mr. Miller, the Chairman, who is not present, I will state that a large amount of work was done on this pipe standard matter during the current year. Several sets of plates were prepared, and one, the final set, is now in the hands of the pipe founders. We were not ready to meet the Committee in conference in time to make any report. Mr. Miller's work has been somewhat delayed by his change in location this year; but I think, while substantial progress has been made, we are not in shape to make any definite recommendation. The Committee will undoubtedly be continued, and the

work which has been done this year will be of substantial advantage to the next committee in completing the work.

The President—Is there any further business to come before this session? If not, a motion to adjourn is in order. [Adjourned to 2:30 P.M.

FIRST DAY—AFTERNOON SESSION.

The meeting was called to order by the President at 2:30 P.M., who asked Mr. Walton Forstall to kindly read the paper, by Mr. A. E. Forstall, on the

"SLIDING SCALE" REGULATION OF PRICES AND RATES OF DIVIDEND FOR GAS COMPANIES.

The early recognition of the fact that all men, and not especially those from Missouri, have to be "shown," that is, must learn from actual experience rather than from the example of others, is indicated by various ancient proverbs. Such a necessity seemed reasonable when only inadequate means existed of ascertaining the exact facts, as to the experience of others and the results of this experience, but seems very unreasonable whenever, as is now usually the case, it is possible to obtain complete information in regard to the history of the development of an industry in the country in which it originated, and the method of conducting it which this development has has proved to be the best of those known at present. Nothing, however, shows greater inability to profit by the experience of others, and in this way save the disastrous results of repeating experiments which have failed, than does the development in the United States of the control of the prices charged and the rates of dividend paid by gas companies.

In spite of the facts that the business had already had in Great Britain a history covering about 50 years when it began to become of importance in this country, and that the teachings of this history were recognized and proclaimed by the leaders on the technical side of the industry many years ago, the gas industry here was allowed, or rather forced, to parallel the experience in Great Britain.

This had shown unlimited competition between gas companies to be detrimental, not only to the companies but also to the communities served by them, but nevertheless such competition was advocated and put into effect in this country as if it were perfectly untried. Only after the goal of low prices for gas had been placed at a much greater distance, and rendered much more difficult of attainment by the excess of snvestmedt necessarily involved in competition between gas companies, was the next stage reached. This stage was practically that of maximum price and maximum dividend, which had already been tried in Great Britain and largely discarded in favor of something better. Again was this experience ignored, and for the last 20 years the method of regulation followed in the United States has been, with only one important exception, that which Great Britain began to discard in 1875. Only within the last 5 years has any general consideration been given to the adoption in our country of the system of regulation which has been in satisfactory operation in Great Britain for over 30 years.

This system is that of the "sliding scale." It consists in the determination for each company of the proper initial or standard price for gas and rate of dividend upon the stock, and the provision that for unit reduction or increase in the price of gas, the rate of dividend may be increased or shall be decreased by a definite amount. The theory is that the initial price being such as will enable the company under fair management to earn and pay, and to continue to earn and pay, the initial rate of dividend, the incentive to and the reward of management sufficiently better than fair to make possible a reduction in the price is found in the increased rate of dividend which can then be paid if earned, while, on the other hand, with poor management it is impossible to continue paying the initial rate of dividend by increasing the price. The community, on the other hand, since it is only entitled to the results of fair, average management, benefits by the reduction in price secured by better management, and is not made to suffer all the loss resulting from poor management. Practical working in Great Britain for 34 years has shown that the theory is correct, and that the sliding scale system furnishes a community of interest between company and consumer which is not reached in any other way. Even in the few cases where the incentive afforded by it has not proved sufficient to produce the better management, neither the community nor the company has occupied any worse position than would have been occupied under any other system of regulation that has obtained in the United States. It would, therefore, seem that the adoption of the system was not only advisable but imperative, if the greatest benefits derivable from the industry for both consumers and companies are to be obtained. It is essential, however, that the basic quantities of initial price, rate of dividend and amount to which this rate is to apply, and the relation between change in price and change in rate, shall be fairly determined in each individual case. In Great Britain this determination is made by committees in Parliament appointed at each session to consider and report upon the "private bills" by means of which all "statutory" gas and other companies are originally incorporated, and also obtain authority to raise such new capital as is required from time to time. These committees hear evidence from the promoters and opponents of each bill as to the probable cost of gas, the value of the property and the reasonable rate of return upon this value, and, after consideration of this evidence, fix the initial rate of dividend and the initial amount of capital upon which this rate may be paid. The relation between change in price and change in rate of dividend is made practically the same in all cases, the customary rate of variation belng ¼ of 1 per cent. for each change of 1 penny or 2 cents in price. The committees also determine the amount of new securities which may be created and issued from time to time to raise the capital required for the extensions of plant needed to meet the demands of the business. These new securities are authorized in advance of the need of issuing them to such an amount as is estimated to be sufficient to provide for the demands for from 10 to 12 years to come. They can be issued as the company sees fit, but since they must all be sold at auction, and cannot be issued to stockholders at par, there is no temptation to issue them in advance of the need for the money.

Since no equivalent of the Private Bill Committees is found either in Congress or in the Legislature of the various States, the adoption of sliding scale regulation in the United States would involve the selection of the body by which the basic quantities of the system are to be established for each company or its creation in those cases where no suitable body is now in existence. In States possessing public service commissions the work would properly be included among the duties of these commissions, either by virtue of their existing powers in regard to the fixing of rates, if these are sufficiently broad, or by means of suitable amendments to the acts authorizing them. Such amendments should contain merely the general authority, leaving the application to individual cases entirely in the hands of the commissions. In States which do not already possess such commissions it would seem as if it would be necessary to create them in order to put the system into effect, since the legislatures have neither the time nor the ability to conduct the investigations into the circumstances of each individual case that must necessarily be had before the basic quantities can be determined correctly.

The legislatures already have the power to regulate rates, and what is here advocated is merely the delegation of this authority, to be exercised in accordance with general rules laid down by the legislatures, to bodies which, if properly constituted, are more competent for the purpose than the legislatures. The determination of the proper initial price, the proper initial rate of dividend and the proper amount upon which to allow the payment of this rate at the start involve practically the same investigation of the circumstances of each case as is necessary for the fixing of the proper rate under present methods of regulation; but, with these quantities properly fixed, there would be no occasion to repeat the process as must now often be done.

This fact of the practical permanence of the initial price makes it essential that this price, when fixed, shall contain a margin for contingencies beyond the control of the management, such as increase in price of gas making materials, and shall also be such as to recognize and reward management better than average where it exists. In British practice the contingency element is recognized by permitting the company to earn, in addition to the amount required to pay the initial, or any increased rate of dividend, extra amounts which can be set aside yearly to an insurance fund at the rate of 1 per cent. of the paid up capital of the company, or added to the amount carried forward into the next year's accounts, until this amount is equal to that required to pay the dividend for a full year at the rate corresponding to the price then charged. The amount carried forward can be used to pay dividends when these are not earned and thus help to take care of fluctuation in prices of materials, but the insurance fund can be used only to meet extraordinary claims and damages arising from accidents which "due prudence and management" could not have prevented, nor can it exceed a total equal to 5 per cent. of the capital of the company.

A careful following of the hearings on the bills of gas companies and the action of the committees after these hearings, as reported at great length in the *Journal of Gas Lighting*, etc., has left the impression that there are few, if any, cases, in which the initial price incorporated in the company's Act has not been higher than that at which it was selling gas at the time, thus placing the company in a position to pay a higher rate of dividend than the initial one if it could earn it at the existing price. In view of the invariable practice of complainants in rate cases to advocate the fixing of a price based upon the, from their standpoint, most favorable view of the expenses of operation for a single year, this necessity of providing for accident and contingencies and rewarding existing good management must not be lost sight of in the adoption of sliding scale regulation.

The initial rate of dividend and the initial amount upon which this rate should be paid are to a great extent dependent upon each other, and the relation between them can be varied widely without affecting the interests of the community, provided that the product of the rate and the amount does not exceed the amount produced by a fair rate of return upon the value of the property. This fact has been recognized in Great Britain by the conversion in the case of a number of companies, of stocks entitled to an initial dividend of 10 per cent. and and actual one of from 12 per cent. to 14 per cent. into an amount of stock entitled to an initial dividend of 4 per cent. or 5 per cent. which would yield the same total amount of dividend. That is, a 10 per cent. stock would be converted into twice the original amount of 5 per cent., or 2½ times the original amount of 4 per cent. stock. The variation in the rate of dividend for unit change in price would also be reduced in the same proportion. Provided the total amount which can be paid in the way of return upon the investment is properly fixed, it is also true that the division of this total, between interest on bonds and dividends on stock, either preferred or common, has no effect upon the interests of the community as a body of gas consumers. These points can be settled, therefore, with a view solely to offering the greatest attraction to the investment of capital in the business consistent with the proper application and efficient administration of the system. The latter consideration would seem to require that, in issuing new securities, after the rate or rates of dividend upon the securities authorized at the time the system is applied have

been fixed, a definite relation shall be maintained between the amount of stock subject to the provisions of the sliding scale and that of whatever securities of other descriptions the company may be authorized to issue. For instance, a company might be permitted to issue equal amounts of bonds bearing a fixed rate of interest and of stock subject to the sliding scale for its rate of dividends, or the issue of bonds might be limited to ½ or ⅓ the amount of stock. It is very desirable that all stock subject to the sliding scale should carry the same rate of dividend, and the necessity of having this rate such as to make the stock an attractive investment, without having it so high as to cause the stock to sell at too great a premium, should be borne in mind when fixing the amount of stock which is to be authorized when the sliding scale is first applied in any particular case.

While the amount, character and rate of interest borne by the securities authorized for immediate issue when a company is put under sliding scale regulation are immaterial to the community, it is important that the total annual amount of interest and dividends be fairly and correctly fixed. It would seem that the most equitable method of doing this would be to pay no attention, at first, to the securities actually outstanding at the time, but to value the property of the company as a going concern and determine the proper rate of return upon this value. From these factors, the total annual return to be allowed is determined. The value as a going concern would necessarily include, in addition to the value of the physical plant and working capital, an allowance for the value of an established business which, although it is as real an asset as a stack of retort benches or a gasholder, is commonly called an intangible asset because its value cannot be measured in exactly the same way as can those of the different parts of the physical property.

The rate of return to be allowed ininially upon this value should be determined separately for each individual case, since no one rate can be taken as being fair under all conditions. In all cases, however, it should be higher than the rate at which bonds or preferred stock of gas companies can be sold, since it is impossible to secure all the money needed for the establishment of a gas plant and its business by means of bonds and preferred stock bearing the ordinary rates of interest. Some of this money cannot be obtained unless there is a practical certainty that it will, in the long run, return more than the rate of interest that can be secured by investment in the bonds or preferred stocks of well established companies, whose net earnings available for interest and dividends are much larger than the amount of bond interest or preferred dividends. This larger rate of return is expected to be secured with ordinary management and must be recognized, therefore, in the initial rate of return, the reward for management better than ordinary being obtained by the increase in rate of return as the price of gas is reduced.

The rate of return upon the capital required for the extension of a well established business, after the company has been put under the sliding scale, will take care of itself if provision is made that the sliding scale securities are to be sold at auction at or above a price to be fixed in advance of the sale, and that all premiums received from such sale at prices, above the par value of the securities, are to be applied to the extension of the business, but will not be entitled to a return. As the business becomes sufficiently established to be attractive to capital at a lower rate of interest the price at which the stock can be sold will be increased and the actual rate of return upon the money put into the property will decrease.

If, as previously indicated, part of the capital is raised by preferred securities assured of a fixed interest which, by reason of being certain, can be made smaller than the rate of return properly expected as an average on the whole investment, the ordinary sliding scale stock can be given a correspondingly higher standard rate of dividend and can be made more attractive without in any way prejudicing the interests of the consumers or the community as a whole. This is so because consumers and community are affected only by the total amount collected from them in the shape of return on any given amount of capital invested in the business, and are not at all concerned about the way in which this total return is divided, by mutual agreement, between the different persons furnishing the capital.

The fixing of the extent to which the rate of dividend on stocks under the sliding scale shall change for unit change in price of gas would seem to deserve more careful consideration than has been given to it in Great Britain. Under the provision that the rate shall always change ¼ of 1 per cent. for each change of a penny in price the proportion borne by the total amount of extra dividend allowed the stockholders to the saving accruing to the consumers has grown steadily smaller, until in some cases it is as small as 1 to 6, or even 1 to 7. The result of this has been to decrease the incentive to achieve further reductions. A special committee, appointed by the House of Commons in 1899, to inquire into the "Powers of Charge Conferred by Parliament on the Metropolitan Gas Companies and to Report as to the Method in which these Powers have been Exercised," advised that, as an extra incentive, "A secondary or additional scale be imposed, which should permit of an increase or decrease of dividend over and above that regulated by the present scale of ¼ per cent. for every complete 3d. of decrease or increase below or above the standard price of 3s. 3d." The South Metropolitan Company adopted this suggestion in a modified form, but it has not been put into force in the exact shape proposed by the Committee.

There is no good reason why the savings effected by the management better than average should not be divided equally between the consumers and the company, not only at prices for gas near the standard price, but also at those far removed from the standard. This equal division cannot be exactly obtained by any fixed relation between change in rate and change in price, unless the amount of securities under the sliding scale is always the same per 1,000 cubic feet of gas sold. This amount will, however, vary from year to year and tends to decrease constantly, not only because the actual investment per 1,000 cubic feet of gas sold tends to decrease as the business is built up in any given community, but also for the reason that, as the rate of dividend increases and the securities command a premium, part of the investment required will be supplied by the premiums, and, therefore, will carry no return.

In order that there shall be an equal division of the saving, in spite of changes in the amount of sliding scale securities outstanding per 1,000 cubic feet of gas sold per year, it must be provided that a change of 1 cent in the price of gas shall carry with it a change in percentage rate of dividend to be obtained by dividing 1 by the number of dollars of sliding scale stock outstanding per 1,000 cubic feet of gas sold in the year immediately preceding. Thus, if there were, say, $4 of sliding scale stock per 1,000 cubic feet of gas sold, the rest of the investment being represented by securities with fixed rates of interest and priority of claims, the rate of dividend would change ¼ of 1 per cent. for each change of 1 cent in the price, while, if the sliding scale stock were $3 per 1,000 cubic feet, with more of the other securities in proportion, the rate of dividend would change ⅓ of 1 per cent. for each change of 1 cent in the price. Under such regulation the company and the consumers would each receive ½ of any saving effected by the energy and skill of management better than average, and this equal division would continue, no matter how the relation between investment and sales varied, nor how this investment was divided between fixed rate and sliding scale securities.

By the method outlined above the sliding scale system could be applied to the regulation of any gas company with no disturbance of existing conditions, unless the company were earning more than a fair rate of return upon the value of its property, and even in such a case the disturbance would be no greater than if the ordinary form of rate regulation were applied. In Great Britain an official audit of the accounts of companies under the sliding scale must be made, and their approval by the auditor obtained before any dividends can be declared. In the only case of sliding scale regulation in force in this country no such official audit is included, but the company is required to publish its accounts each year in one or more of the newspapers of the city, and has had its accounts audited by public accountants before making this publication. It would seem, therefore, that an official audit is not an inherently necessary part of the system.

It is not necessary that companies should come under sliding scale regulations when first incorporated. In fact, it would be a very difficult matter to accurately fix the basic quantities, upon which the success of this system depends, for a company starting business in a new territory. The business must have been carried on for a sufficient length of time to have become fairly well established before it is for the best interests of either company or community that the sliding scale be applied to it. In Great Britain all of the companies now under sliding scale regulation had been in existence for many years before it was applied to them, and many of the smaller companies are still working as limited liability companies without any statutory rights. The advantages to be derived from the application of the sliding scale are sufficient to insure that if it has been generally and fairly applied to the established companies, the new companies that may be formed will take steps to come under it as soon as they have passed the formative period and reached such a position that it is possible to fix a fair standard price and rate of dividend for them.

As will be seen no attempt has been made in this paper to formulate a complete detailed scheme for the application of sliding scale regulation to American conditions in the gas business. This can be done only by the combined efforts of men skilled in the gas business and in the art of making laws. It is hoped, however, that the general statement which has been made of the way in which it seems to the writer best to handle the salient features of the problem, with the discussion of this statement, will furnish material that can be used to advantage when the detailed scheme is formulated.

In an appendix will be found a brief history of gas legislation in Great Britain, and extracts from various acts applying the sliding scale and auction clauses.

(To be Continued.)

Meeting Times of the Various Gas Associations.

American Gas Institute.—Annual meeting, October, 1910. Atlantic City, N. J. Officers: President, Wm. H. Bradley, N. Y., City; Secretary, A. B. Beadle, 29 West 39th street, N. Y. City.

Canadian Gas Association.—Annual meeting, June, 1909. Hamilton, Ont. Officers: President, J. S. Norris, Montreal, P. Q.; Secretary and Treasurer, A. W. Moore Woodstock, Ont.

Empire State Gas and Electric Association.—Annual meeting, Nov., 1910. New York City. Officers: President, C. R. Huntley, Buffalo, N. Y.; Secretary, C. H. B. Chapin, 29 W. 39th street, New York City.

Guild of Gas Managers of New England.—Annual meeting, December. Young's Hotel, Boston; monthly meeting, second Saturday. Officers: President, A. K. Quinn; Newport, R. I.; Secretary, Walter G. Africa, Manchester, N. H.

Illinois Gas Association.—Annual meeting, time, March 18, 1910, Chicago, Ills. Officers: President, E. G. Schmidt, Springfield, Ills.; Secretary-Treasurer, C. B. Strohn, Elgin, Ills.

Illuminating Engineering Society.—Annual meeting, January 14, 1910. Meetings of Sections, monthly. President, W. H. Gartley, Philadelphia, Pa.; Secretary, Preston S. Millar, 29 W. 39th street, N. Y. City. Sections: New York: Secretary, Albert J. Marshall, 227 Fulton street. New England, Secretary, L. D. Gibbs 39 Boylston street, Boston, Mass. Philadelphia, Secretary, F. N. Morton, Broad and Arch streets. Chicago, Secretary, T. R. Beebe, 157 Michigan avenue,

Indiana Gas Association.—Annual meeting, January 19, 1910, Indianapolis, Ind. Officers: President, J. W. Dunbar, New Albany, Ind.; Secretary-Treasurer, Philmer Eves, Indianapolis Gas Company, Indianapolis, Ind.

Iowa District Gas Association.—Annual meeting, time, June 23, 24, 25, 1910, Sioux City, Ia. Officers: President, Geo. H. Waring, Omaha, Neb.; Secretary and Treasurer, G. I. Vincent, Des Moines, Ia.

Kansas Gas, Water and Electric Light Association.—Annual meeting, time, ———— Wichita, Kas. Officers: President, W. A. Scothorn, Hutchinson, Kas.; Secretary and Treasurer, J. D. Nicholson, Newton, Kas.

Michigan Gas Association—Annual meeting, time, September, 1910; ———— Officers: President, B. O. Tippy, Grand Rapids, Mich.; Secretary-Treasurer, Glenn R. Chamberlain, Grand Rapids, Mich.

Missouri Electric Light, Gas, Water Works and Street Railway Association.—Annual meeting, April 14, 15 and 16, 1910; Jefferson City, Mo. Officers: President, W. A. Bixby; Secretary and Treasurer, C. L. Clary, Sikeston, Mo.

National Commercial Gas Association.—Annual meeting, third week in October, 1910: Boston. Officers: President, E. N. Wrightington, Boston; Secretary, Lucius S Bigelow, 106 Fulton street, New York City.

Natural Gas Association.—Annual meeting, May 17, 18 and 19, 1910; Oklahoma City, Okla. Officers: President, William H. McKenzie, Kansas City, Kas.; Secretary, T. C. Jones, Delaware, O.

New England Gas Association.—Annual meeting, third Wednesday in February; Boston. Officers: President, Walter G. Africa, Manchester, N. H.: Secretary-Treasurer, N. W. Gifford, East Boston, Mass.

Oklahoma Electric Light, Railway and Gas Association.—Annual meeting, May 18, 19 and 20, 1910; Oklahoma City. Officers: President, F. H. Tidman, Oklahoma City, Okla.; Secretary-Treasurer, Galen Crow, Guthrie, Okla.

Pacific Coast Gas Association.—Annual meeting, ————, 1910, Los Angeles, Cal. Officers: President, W. B. Cline, Los Angeles, Cal.; Secretary-Treasurer, John A. Britton, 925 Franklin street, San Francisco, Cal.

Pennsylvania Gas Association.—Annual meeting, April 13, 1910, Easton, Pa. Officers: President, E. G. Holzer, Easton, Pa.: Secretary-Treasurer, William H. Merritt, Lebanon, Pa.

Society of Gas Lighting.—Annual meeting, December, 1910; monthly meeting, second Thursday. Place, New York City. Officers: President, Fred. S. Benson; Secretary, George G. Ramsdell, 1123 Broadway, New York.

Southern Gas Association.—Annual meeting, Feb. 16, 1910, Chattanooga, Tenn. Officers: President, R. C. Congdon, Atlanta, Ga.; Secretary-Treasurer, James Ferrier, Rome, Ga.

Southwestern Electrical and Gas Association.—Annual meeting. ————, 1910, Beaumont, Tex. Officers: President, R. B. Stichter, Dallas, Tex.; Secretary's office, 300 Commerce street, Dallas, Tex.

Wisconsin Gas Association.—Annual meeting, May 11 and 12, 1910, Milwaukee, Wis Officers: President, R. B. Brown, Milwaukee, Wis.; Secretary-Treasurer, H. H. Hyde, Racine, Wis.

Items of Interest
FROM VARIOUS LOCALITIES.

MR. HARRY CRAFT, who will be remembered from his active connection with the Northampton (Mass.) Gas Company, has been elected Vice-President of the Pittsfield (Mass.) Aero Club.

AT the annual meeting of the Slatington (Pa.) Gas Company the officers elected were: President, Walter L. Jones; Treasurer, Joseph Richards; Secretary, Harry E. Griffin; Directors, Dr. A. L. Kistler, Joseph Richards, Walter L. Jones, John Taylor, Wm. H. Gaugemer, Robert G. Pierce and Guy R. Jones.

MESSRS. CHAS. C. SMITH, Frank A. Byrne and Jno. P. Mein, of Brooklyn, N. Y., figure as Directors of the Associated Employees of the Department of Water Supply, Gas and Electricity, of Manhattan. The incorporation papers were recently filed with the Secretary of State.

THE employees of the Inter Urban Gas Company, Geneva, N. Y., have organized an Employees' Association, which body is formed for the better instruction of its members in their trade and art, and to promote and maintain friendly relations. The officers chosen to manage its initial affairs are: President, Frank Roe; Treasurer, George Turner; Secretary, John Walsh. Its meetings will be held twice a month.

A CORRESPONDENT in Evansville, Ind., writing under date of the 15th inst., forwards this: "To interest the women and girls of this city a special concession has been made by the Domestic Science Department of the Corn School Association. It was felt that, inasmuch as the larger part of the expense of the school and exposition is being borne by the city merchants, manufacturers and jobbers, that city people should be much interested in the domestic science department. To attract the city women, a special rate on membership tickets, good in the domestic department alone, has been authorized. For 25 cents any woman or girl residing inside the city limits may take the complete week's course in domestic science. Her ticket will admit to only cooking classes and cooking demonstrations. The payment of this sum, which is hardly nothing, and which goes to bring the school back to Evansville again, also entitles the holder to compete for all city prizes and for district prizes. The prizes for cakes, bread and butter offered by the various counties will not be open to city women. But the district sweepstakes, which have fireless cookers, folding beds and cash prizes, will be open to the city women. The School of Domestic Science will be taught by the head of the Domestic Science Department of Purdue University, Professor Henrietta Calvin. Classes, demonstrations and prize baking contests will be held in Evans Hall. The Evansville Gas and Electric Light Company will install, at its own expense, a battery of gas ranges on the stage at Evans Hall. The Gas Company will also furnish free gas for the cooking school. General Manager Blinn of the Company, when asked by a Corn School and show official to aid the enterprise proffered his help at once. Over and beyond furnishing the ranges and fuel free, he offered four prizes, to be competed for exclusively by women residing in Evansville. These prizes are: To best white loaf cake baked by anyone now not using gas for cooking purposes, a 4-burner standard gas range, with oven and pan. Range will be connected free. The best devil's food cake baked by anyone now not using gas for cooking purposes, same prize as above. To best white loaf cake baked by anyone using gas for cooking, 10,000 feet of gas. To best devil's food cake baked by anyone now using gas for cooking, 10,000 feet of gas. Second and third prizes will be announced later. According to Professor Calvin, the instruction to be given here will be worth dollars and cents to every housekeeper in Evansville. She will show how to save on grocery bills. As the class will be limited to 1,100 in membership, including the women and girls who attend from over the district, the tickets will be put on sale over the city at places yet to be designated. Professor Calvin and her assistants will be the judges of the cakes baked in the prize contests. An Evansville woman will have charge of the special Evansville prize contests, in so far as to see that the rules are complied with. Of special interest to Evansville people, especially those who are interested in civic improvement and the 'clean-up" movement, will be special lectures on lawn and yard beautification by a Purdue Professor. He will instruct in the matter of grass sowing, shrub and vine planting, landscape gardening and will give most valuable information to those who will compete, later in the year for civic improvement society prizes."

AT the annual meeting of the Grand Ledge (Mich.) Gas Company these officers were elected: President, E. E. Edwards; Treasurer, M. H. Maier; Secretary, C. Alexander; Directors, J. D. Summers, E. E. Edwards, C. Alexander, C. J. Tucker and M. H. Maier.

AT the annual meeting of the Newport (R. I.) Gas Company the officers chosen were: President, Henry Bull; Secretary, Thos A. Lawton; Treasurer, A. K. Quinn; Directors, Henry Bull, Thos. A. Lawton, Andrew K. Quinn, W. R. Hunter and Packer Braman. Mr. Hunter was named to succeed the late Dr. W. T. Bull, and Mr. Braman succeeds the late Mr. Melville Bull.

MR. HOWARD MARK, who has for some time been a representative on the staff of the Suburban Gas Company, of Chester, Pa., has been appointed Manager of the Coatesville branch of the Company, in so far as its commercial department is concerned.

IT looks only a matter of short time when the gas and electric supply of Peabody, Mass., will be under the domination of the Lynn (Mass.) Gas and Electric Company.

AT the annual meeting of the Willimantic (Conn.) Gas and Electric Light Company the following officers were re-elected: President, Alexander J. Campbell; Vice-President, F. C. Slade; Treasurer and Secretary. J. A. Southard. The officers, with Messrs. James Ahearn and H. C. Murray, constitute the Board of Directors.

MR. R. K. COWARD, who has occupied the position of Superintendent to the Federal Gas Company, of Boulder, Col., since July 1, 1908, seems to be the right man for the place, if one may take this note, printed in a recent issue of the Boulder *Camera*, as speaking

by the book. "The prosperity of a city to-day is often judged by the volume and nature of its artificial lighting, and Boulder certainly reached a high state of development in this respect due to the efficiency and excellence of the service furnished by the Federal Gas Company. Since its inception (1902) the policy of the Company has been broad and progressive, and every effort consistent with good business practice is made to please its patrons. Wherefore, the citizens of Boulder are justly proud of the Company, and in proof whereof they are giving it loyal support. The Company is making main extensions with rapidity, and last year well over 2 miles of pipes were added to the system. During the past year the Company put out scores of appliances for cooking and heating by gas; the greatest success in this division seems to be the favor granted by housekeepers to a new water heater of the copper coil type. The offices have been remodeled, and the Company now has the satisfaction of holding forth in business headquarters that are really a city show place. The officers of the Company are: President, T. V. Wilson; Vice-President, Jonas Bergheim; Secretary and Treasurer, Lester J. Moulton. The outlook is excellent."

THE proposed ordinance under which the Richmond (Ind.) Natural Gas Company asks to be permitted to manufacture and distribute artificial gas in the named city, and which is now before City Councils, is attracting much attention. The main line of divergence of opinion has reference to the maximum selling price. The Company asks for 90 cents per 1,000, and the city persists in insisting on 75 cents. A compromise, on the basis of 95 cents, gross, and 85 cents net, has been suggested.

AT the annual meeting of the shareholders in the Fresno (Cal.) Gas Company the following result was reached: Directors, Lewis Leach, Alex. Badlam, Wm. Faymonville, S. N. Smith and W. W. Phillips; President, Lewis Leach; Vice President, Wm. Faymonville; Treasurer, The Farmers' Bank; Secretary, L. L. Dixon.

MR. S. C. ROWLAND has resigned the position of Manager of the Crawfordville (Ind,) Water and Gas Company to engage on his own account in the business of selling, leasing and operating public service properties.

WRITE to Mr. A. M. Merryweather, Manager of the Ferroinclave Department of the trading or business of the Brown Hoisting Machinery Company, of Cleveland, O., for a copy of its current edition (1910) of the Company's Ferroinclave catalogue. It is a beauty.

MR. M. B. DALY, President and General Manager of the East Ohio Gas Company, of Cleveland, O., will hold like positions in the new $30,000,000 corporation which was formed about a fortnight ago, when the Directors of the East Ohio corporation and the Columbia Gas Company, which took over the Peoples Gas Light Company and the Cleveland Gas Light and Coke Company, met for the purpose of completing merger plans.

THE contract for the buildings to house the plant of the Waynesboro Gas Company, which is to be located in South Waynesboro, Pa., is being carried out by Mr. A. C. Dukehart. The holder provision calls for a vessel up to retaining 100,000 cubic feet.

AT the annual meeting of the Knoxville (Tenn.) Gas Company, which is set for the 28th inst., the matter of constructing a new gasholder (and other additional plant as well) will be discussed.

IF the revised ordinance, respecting when, by whom and how street mains may be tapped for service connections, which revision is now before City Councils, Richmond, Va., is adopted, the city shall hereafter lay pipe connections from the street main to the interiors of houses without cost to the property owner.

THE new Board of Directors of the Denver (Col.) Gas and Electric Company is thus composed: Willis V. Elliott, Rodney J. Bradwell, Charles Frueauff, H. H. Scott, Paul R. Jones, Henry J. Hughes, J. M. Mulvahill, Thos. F. Kennedy, George W. Bixler, A. F. Travers, Edgar McComb and W. C. Stern.

THE Pawtucket (R. I.) Gas Company has determined not to extend its mains to the outlying settlement of Manville. Next spring it is likely the Woonsocket Gas Company will take up the matter of doing business in Manville.

THE unexpected happened when the special meeting of the shareholders in the Consumers Gas Company, of Atlantic City, N. J., called for the purpose of taking action on a prior resolution (formulated at the December meeting), the essential of which declared, "It is advisable and must be for the benefit of the Company, that same is hereby assented to." The question, however, was not acceded to, the final consideration thereof having been put over until the first week in February.

"T. S. J.," writing from Baltimore, Md., under date of the 14th inst., says: "I am sure some of the readers of your valuable gas publication would be interested in knowing that John E. Dyer, a young man for some time in the Eutaw Station, of the Baltimore Consolidated Gas, Electric Light and Power Company, passed away at his home, 1102 Barclay street, the morning of the 29th ult. Although only in his 22d year, his personality was of the kind that attracted his fellows, and his attention to his duties as well as the intelligent way in which he applied the orders of his superiors, insured for his rapid advance in the Company's service, had nature spared him for life and its way. He was a practicing member of the choir of St. John's Church, Baltimore, and a most affecting part of the final leave taking was the music of the mass for the dead, as interperted by his fellow choiresters, led by Mr. Antony Winkes."

MR. W. N. BEST informs us that he has succeeded personally to the business heretofore done by him under the name and title of the N. W. Best American Calorific Company.

PUBLIC LIGHTING TABLES FOR 1910.

These tables are those used for computing the various times during the year, for New York and vicinity, when public lamps of all sorts are to be lighted and extinguished. As will be seen they include the all night and every night practice, and the moontable schedule as well. These were compiled by the American Meter Company, New York city.

Table No. 1.
FOLLOWING THE MOON.

Day of Week.	Date.	Light.	Extinguish.
Sat.	1	5.10 P.M.	11.50 P.M.
Sun.	2	5.20	12.40 A.M.
Mon.	3	5.20	1.40
Tue.	4	5.20	2.40
Wed.	5	5.20	3.40
Thu.	6	5.20	4.40
Fri.	7	5.20	5.50
Sat.	8	5.20	6.20
Sun.	9	5.30	6.20
Mon.	10	5.30	6.20
Tue.	11	5.30 N.M.	6.20
Wed.	12	5.30	6.20
Thu.	13	5.30	6.20
Fri.	14	5.30	6.20
Sat.	15	5.30	6.20
Sun.	16	10.00	6.20
Mon.	17	11.10 F.Q.	6.20
Tue.	18	12.20 A.M.	6.20
Wed.	19	1.30	6.20
Thu.	20	2.50	6.20
Fri.	21	4.00	6.20
Sat.	22	5.00	6.20
Sun.	23	No L.	No L.
Mon.	24	No L. F.M.	No L.
Tue.	25	No L.	No L.
Wed.	26	5.40 P.M.	7.30 P.M.
Thu.	27	5.40	8.30
Fri.	28	5.40	9.30
Sat.	29	5.40	10.30
Sun.	30	5.50	11.30
Mon.	31	5.50	12.30 A.M.

TOTAL HOURS DURING 1910.

	Hrs. Min.
January	229.00
February	188.20
March	184.10
April	161.40
May	152.00
June	136.50
July	146.20
August	165.50
September	181.30
October	217.10
November	224.50
December	249.30
Total, year	2237.10

Table No. 2.
NEW YORK CITY.
ALL NIGHT LIGHTING.

Day of Week.	Date.	Complete Lighting in 1 Hour.	Complete Extinguishing in 50 Minutes.
		From Time Given.	
		P.M.	A.M.
Sat.	1	4.12	6.27
Sun.	2	4.12	6.27
Mon.	3	4.12	6.27
Tue.	4	4.12	6.27
Wed.	5	4.12	6.27
Thu.	6	4.12	6.27
Fri.	7	4.12	6.27
Sat.	8	4.22	6.22
Sun.	9	4.22	6.22
Mon.	10	4.22	6.22
Tue.	11	4.22	6.22
Wed.	12	4.22	6.22
Thu.	13	4.22	6.22
Fri.	14	4.22	6.22
Sat.	15	4.32	6.17
Sun.	16	4.32	6.17
Mon.	17	4.32	6.17
Tue.	18	4.32	6.17
Wed.	19	4.32	6.17
Thu.	20	4.32	6.17
Fri.	21	4.32	6.17
Sat.	22	4.42	6.12
Sun.	23	4.42	6.12
Mon.	24	4.42	6.12
Tue.	25	4.42	6.12
Wed.	26	4.42	6.12
Thu.	27	4.42	6.12
Fri.	28	4.42	6.12
Sat.	29	4.47	6.07
Sun.	30	4.47	6.07
Mon.	31	4.47	6.07

TOTAL HOURS DURING 1910.

	Hrs. Min.
January	428.30
February	358.15
March	353.10
April	298.10
May	263.20
June	234.45
July	248.30
August	278.00
September	311.25
October	370.05
November	397.40
December	438.35
	3980.25
Deduct on account of 50 minutes extinguishing time	30.25
Total, year	3950.00

The Market for Gas Securities.

Think of it! Just because the bottom fell out of a rotten pool, the noisome fumes therefrom seemed sufficient to stupefy the minds or wits of even the veriest room traders. Prices in things high and low, safe and shaky, went by the board. In the rough-house Consolidated managed to get to 141. To-day (Friday) dealers had become sufficiently sane to cause a rally in Consolidated to 147⅛ to ¼. Brooklyn Union weathered the gale in good shape—today it is back to 154 bid. Every feature in the local situation looks to the good and all in favor of the investor.

The Fall River (Mass.) Company will pay a quarterly dividend of 3 per cent., the 1st inst. Peoples, of Chicago, pays a 1¾ per cent. dividend the 25th prox., and Messrs. A. G. Church and Edward Malensbrook were elected Directors in the Laclede Company, succeeding Messrs. James Campbell and J. F. Beggs.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

JANUARY 24.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share:

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked*
Consolidated Gas Co.	$73,177,000	100	147⅛	147¼
Central Union Gas Co. —				
1st 5's, due 1972, J. & J.	3,000,000	1,000	98	101
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	—	105
Mutual Gas Co.	2,500,000	100	155	165
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	100	101½
New York & Richmond Gas				
Co. (Staten Island)	1,500,000	100	37	43
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	—	100	101
New York and East River—				
1st 5's, due 1944, J. & J.	3,500,000	1,000	104	107
Con. 5's, due 1945, J. & J.	1,500,000	—	97	101
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	94	100
Standard	5,000,000	100	—	75
Preferred	5,000,000	100	70	100
1st Mtg. 5's, due 1930, M. & N.	1,500,000	1,000	100	105
The Brooklyn Union	15,000,000	1,000	154	157
1st Con. 5's, due 1948, M. & N.	15,000,000	—	95	99
Yonkers	299,650	500	130	—
Out-of-Town Companies.				
Bay State	50,000,000	50	¾	⅞
" Income Bonds	2,000,000	1,000	—	75
Binghampton Gas Works	450,000	100	—	65
" 1st Mtg. 5's	500,000	1,000	90	96
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	5	8
Bonds, 5's	5,250,000	1,000	73	73½
Capital, Sacramento	500,000	50	—	35
Bonds (6's)	150,000	1,000	—	—
Chicago Gas Co. Guaranteed				
Gold Bonds	7,000,000	1,000	104	106¼
Cincinnati Gas and Electric				
Co.	29,500,000	100	92	93
Columbus (O.) Gas Co., 1st				
Mortgage Bonds	1,500,000	1,000	96	98
Columbus (O.) Gas Lt. &				
Heating Co.	1,682,750	100	90½	91
Preferred	3,026,500	100	75½	80
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	—	105
Mortgages, 6's	3,000,000	—	—	118
Cheapeake, 1st 6's	1,000,000	—	—	—
Equitable, 1st 6's	910,000	—	—	—
Consolidated, 1st 5's	1,490,000	—	—	112
Consolidated Gas Co. of N. J.	1,000,000	100	15	17
Con. Mtg. 5's	880,000	1,000	92	95
Bonds	75,000	—	—	100
Denver Gas and Electric	458,000	—	102	105
Detroit City Gas Co	5,000,000	50	—	50
" Prior Lien 5's	4,619,000	1,000	97	100⅛
Detroit Gas Co., 5's	381,000	1,000	75	80
Equitable Gas & Fuel Co.,				
Chicago, Bonds	2,000,000	1,000	—	101
Essex and Hudson Gas Co.	6,500,000	—	39	40
Fort Wayne	2,000,000	—	—	—
" Bonds	2,000,000	—	55	—
Grand Rapids Gas Light Co.,				
1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of				
New Jersey	10,500,000	—	112	113½
" Bonds, 5's	10,500,000	—	103	103½
Indianapolis	2,000,000	—	60	70
" Bonds, 5's	2,650,000	—	104½	105
Jackson Gas Co.	250,000	50	82	—
" 1st Mtg. 5's	290,000	1,000	97	100
Kansas City Gas Light Co.,				
of Missouri	5,000,000	100	—	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede Gas Co., St. Louis.	10,000,000	100	106	106½
Preferred	2,500,000	100	—	98
Bonds	10,000,000	1,000	104	—
Lafayette Gas Co., Ind.	1,000,000	100	—	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	143	145
Madison Gas and Electric Co.				
" 1st Mtg. 6's	350,000	1,000	106	106¾
" 6 per cent. scrip,				
due 1910	100,000	25	60	60½
Massachusetts Gas Compan-				
ies, of Boston	25,000,000	100	78	78¼
Preferred	25,000,000	100	95½	96
Montreal Gas Co., Canada	2,000,000	100	218	218¾
Nashville Gas Light Co.	1,000,000	100	110	—
Newark, N. J., Con. Gas Co.	6,000,000	—	56	58
Bonds, 6's	6,000,000	—	137	138
New Haven Gas Co.	2,000,000	25	200	—
Peoples Gas Lt. & Coke Co.,				
Chicago	25,000,000	100	112	112¾
1st Mortgage	20,100,000	1,000	—	—
2d "	2,500,000	1,000	104	—
Rochester Gas & Electric Co.	2,150,000	50	88	—
Preferred	2,150,000	50	118	—
Consolidated 5's	2,000,000	—	104¾	105½
San Francisco Gas Co., Cal.	15,500,000	—	—	—
St. Joseph Gas Co.—				
1st Mtg. 5's	751,000	1,000	100	102
St. Paul Gas Light Co.	1,500,000	100	45	47
1st Mortgages, 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112¼	115
General Mortgage, 5's	2,465,000	1,000	90	95

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SPECIAL MEETING.

OFFICE OF THE UNITED GAS IMPROVEMENT CO.,
N. W. CORNER BROAD AND ARCH STS.,
PHILADELPHIA, December 9, 1909.

A Special Meeting of the Stockholders of The United Gas Improvement Company will be held at the office of the Company, Northwest Corner of BROAD AND ARCH STREETS, PHILADELPHIA, on Wednesday, Feb. 9, 1910, at 12 o'clock, noon, for the purpose of acting upon the subject of a proposed increase in the authorized capital stock of the Company from 1,009,487 shares, of the par value of $50 each, to 1,110,414 shares, of the par value of $50 each.

By order of the Board of Directors.

W. F. DOUTHIRT, Secretary.

The stock transfer books will be closed from 3 P.M., Jan. 28, 1910, until 10 A.M., Feb. 10, 1910.

1801-9

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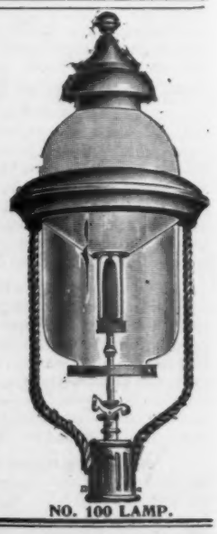
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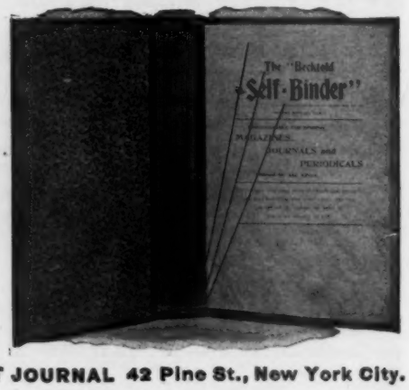

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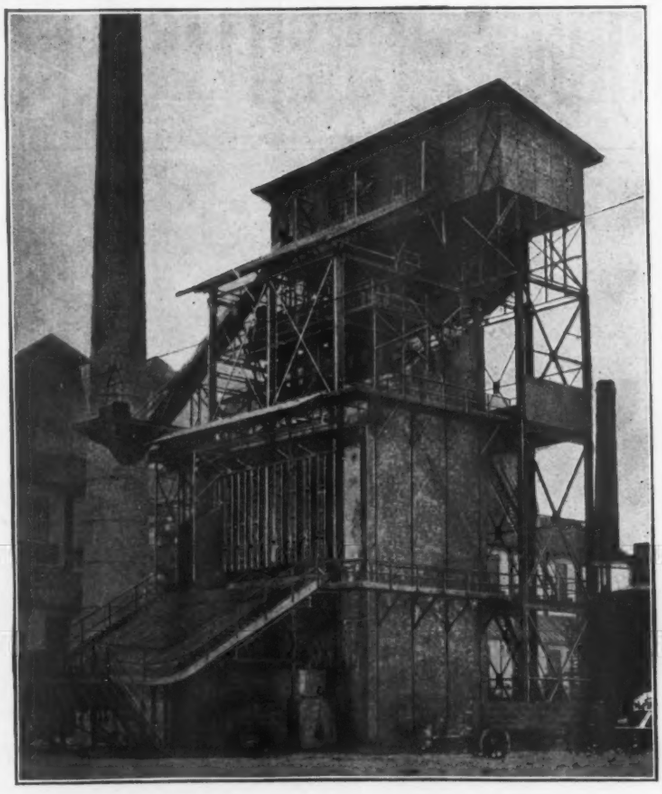

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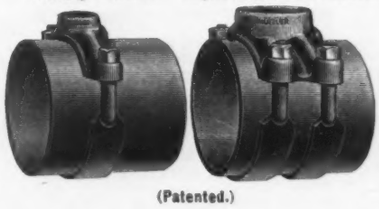

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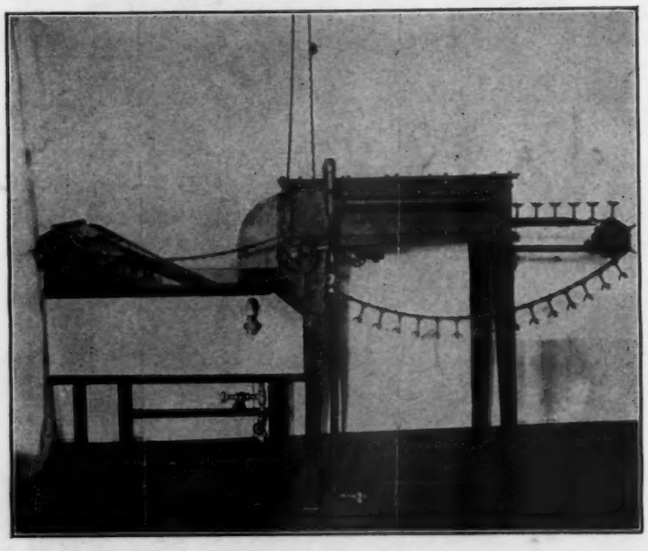

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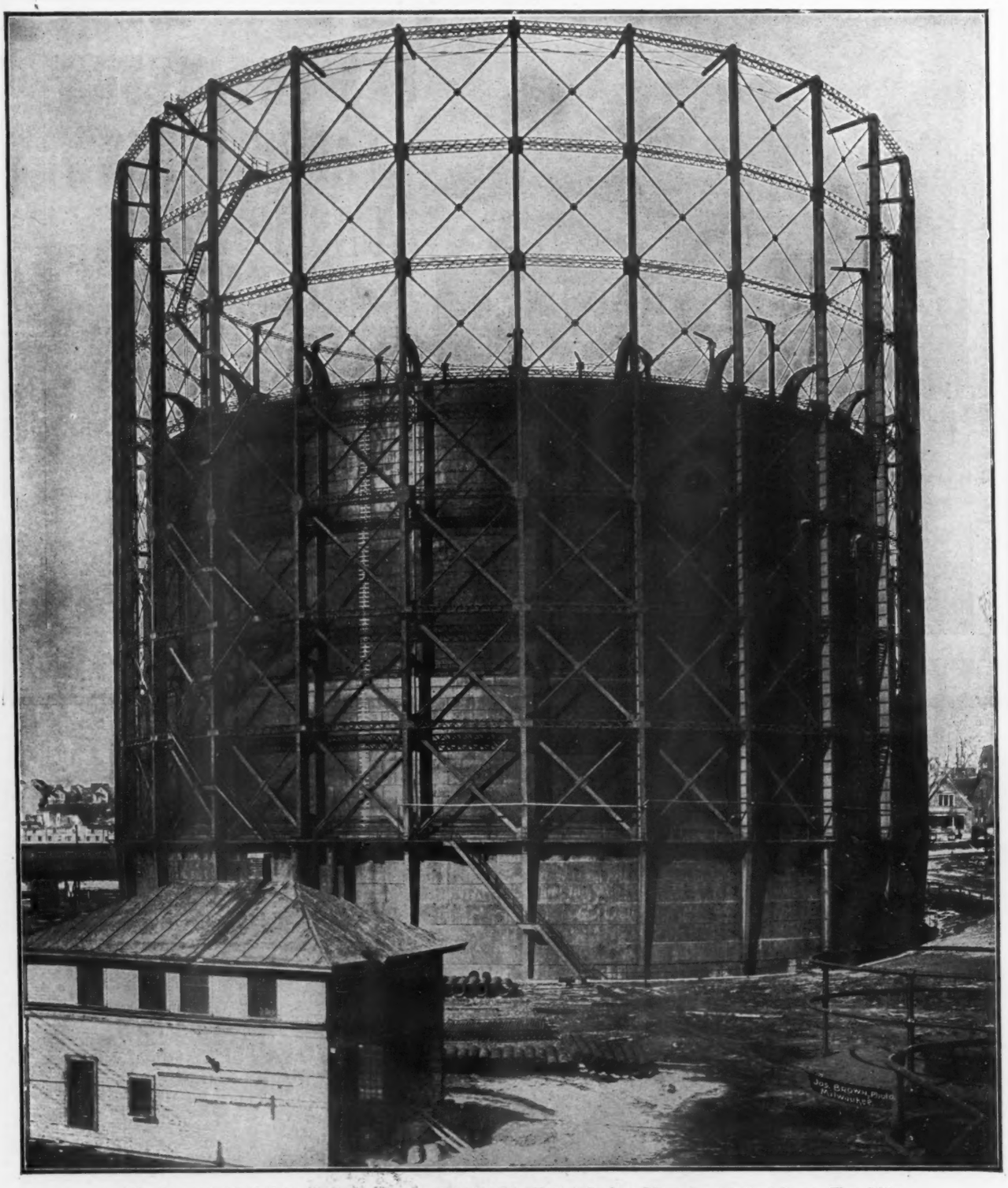

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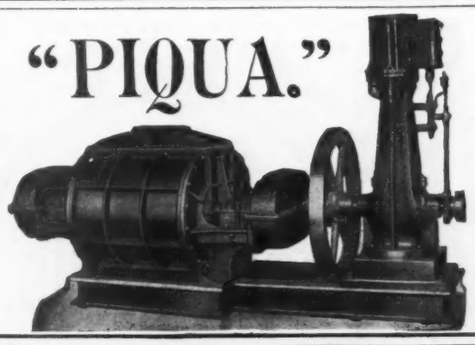

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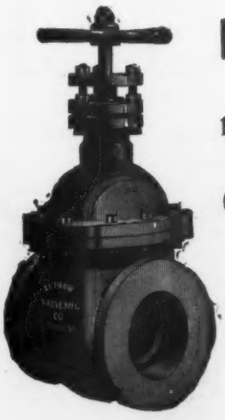

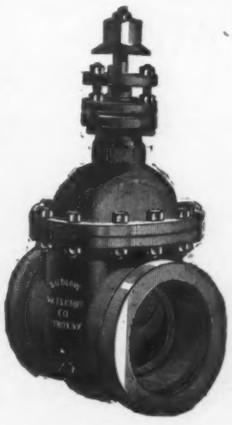

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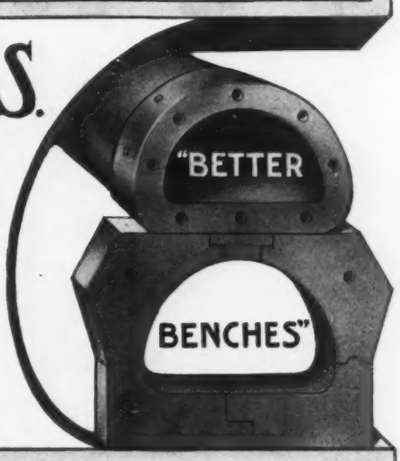

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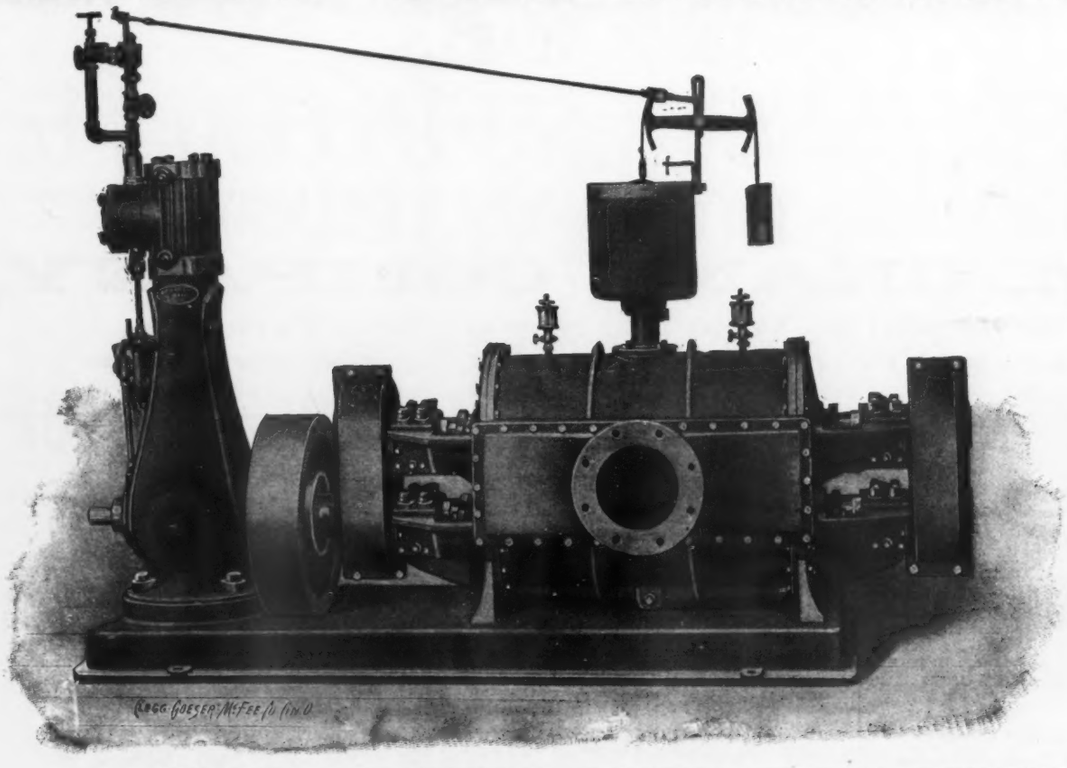

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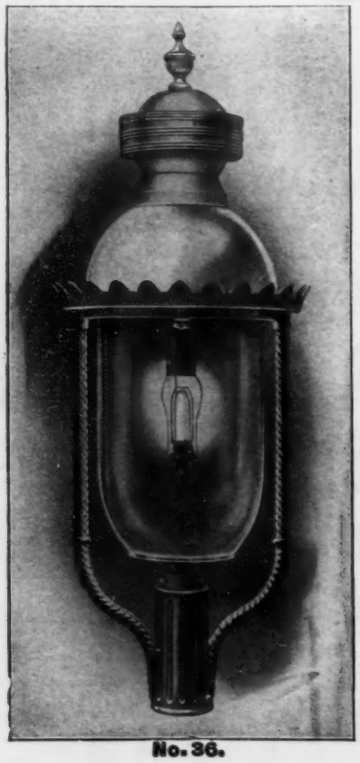

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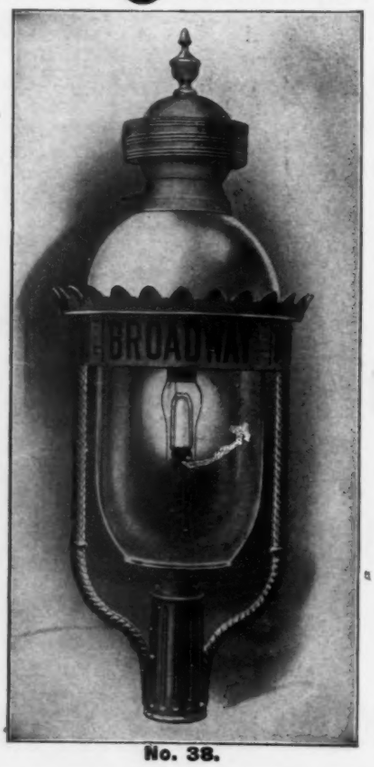

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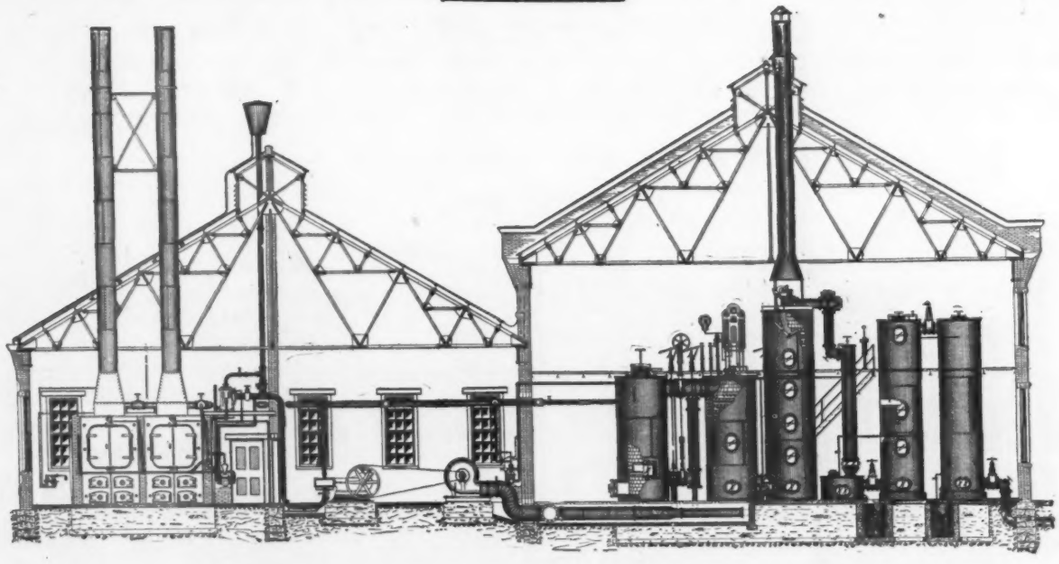

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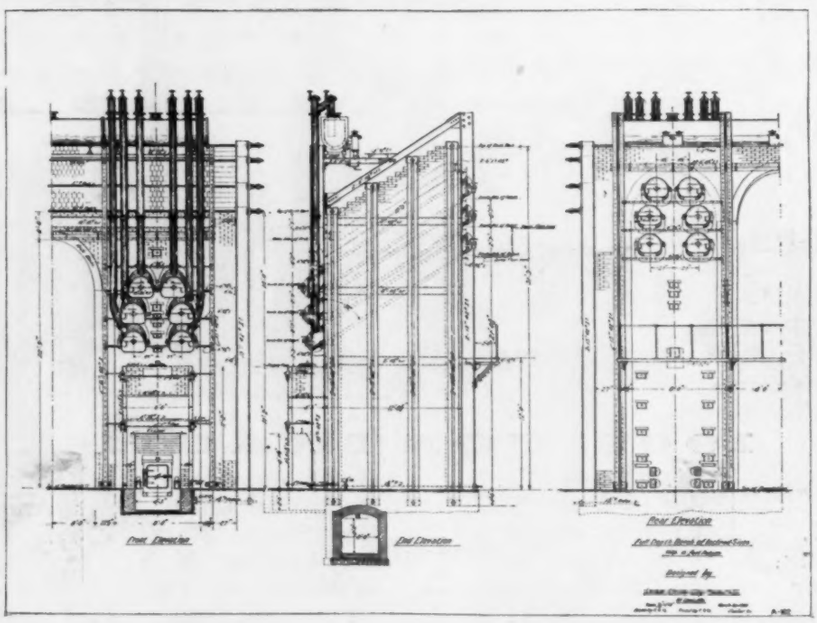

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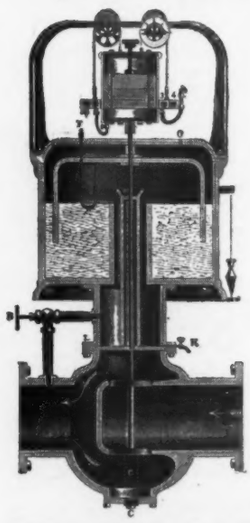

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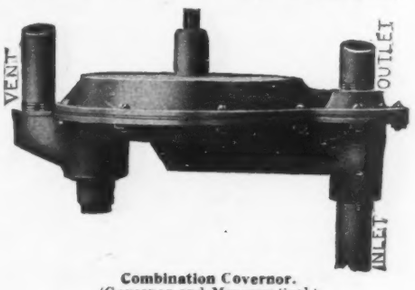

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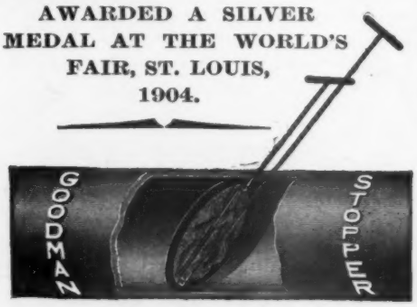

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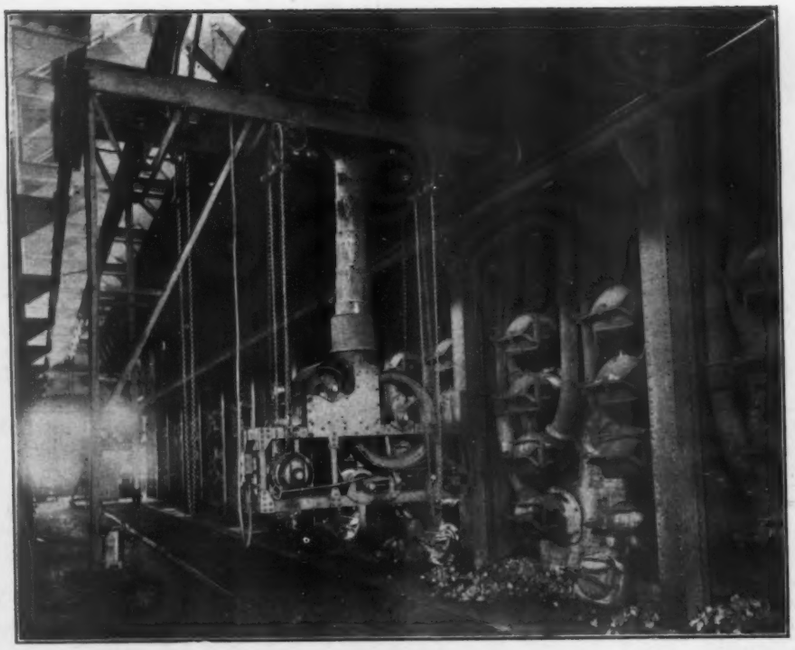

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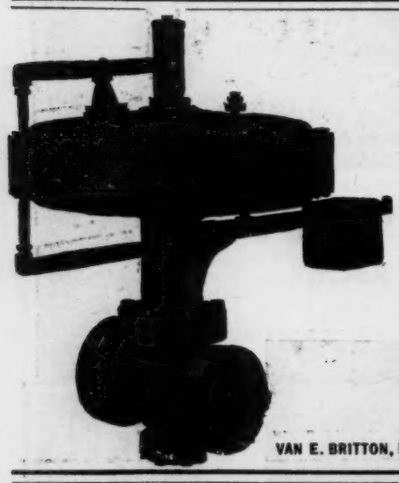

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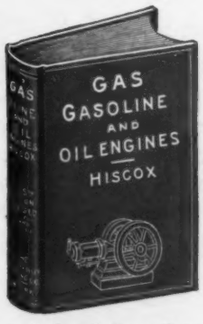

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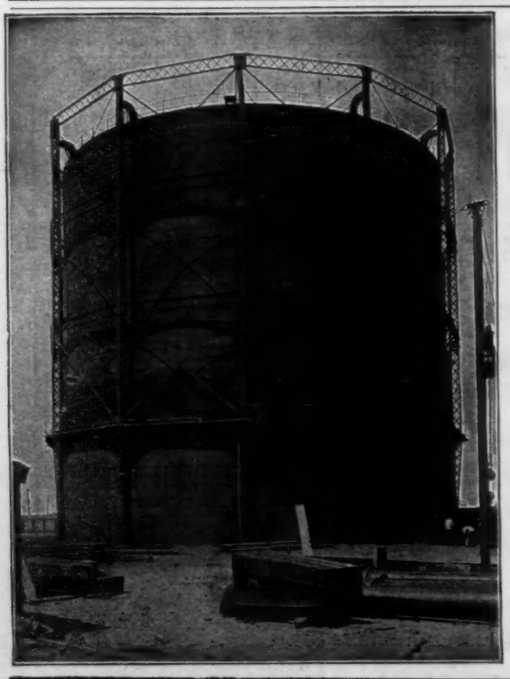

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